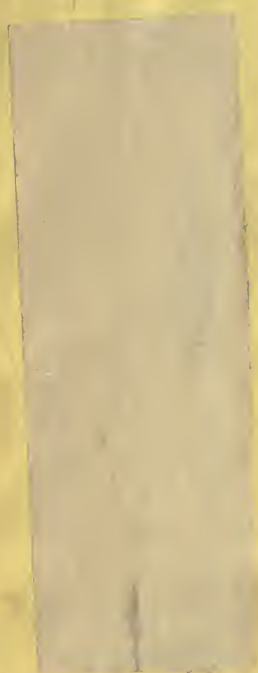


SUTRO



TUNNEL





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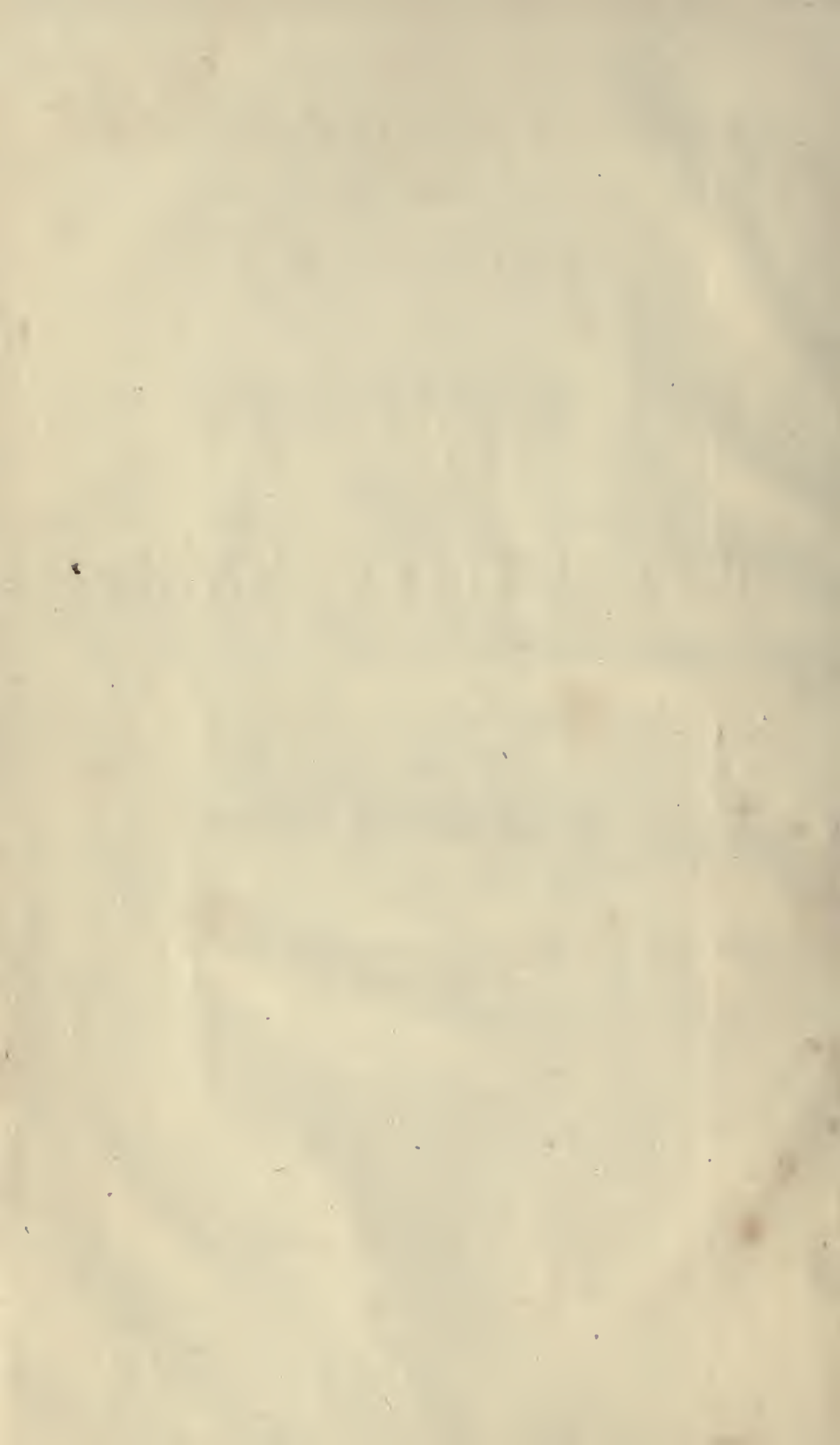
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1900 BIRTH TO 1950

1950 BIRTH TO 2000



REPORT OF THE COMMISSIONERS

AND

EVIDENCE

TAKEN BY

U.S. House
THE COMMITTEE ON MINES AND MINING OF THE HOUSE OF
REPRESENTATIVES OF THE UNITED STATES,

IN REGARD TO

THE SUTRO TUNNEL,

TOGETHER WITH

THE ARGUMENTS

AND

REPORT OF THE COMMITTEE,

RECOMMENDING A

LOAN BY THE GOVERNMENT IN AID OF THE CONSTRUCTION
OF SAID WORK.

WASHINGTON, D. C.:

M'GILL & WITHEROW PRINTERS AND STEREOTYPERS,
1872.

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LAW AUTHORIZING THE COMMISSION.

AN ACT authorizing the President to appoint commissioners to examine and report upon the Sutro tunnel in the State of Nevada.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States is hereby authorized and requested to appoint a board of three commissioners, two of whom shall be officers of engineers of the army and one a mining or civil engineer, to examine and report upon the Sutro tunnel in the State of Nevada; authorized to be constructed by an act of Congress, approved July twenty-five, eighteen hundred and sixty-six, with special reference to the importance, feasibility, cost, and time required to construct the same; the value of the bullion extracted from the mines on the Comstock lode; their present and probable future production; also the geological and practical value of said tunnel as an exploring work, and its general bearing upon our mining and other national interests in ascertaining the practicability of deep mining.

Approved by the President of the United States April 4, 1871.

COMMITTEE ON MINES AND MINING

OF THE

HOUSE OF REPRESENTATIVES OF UNITED STATES:

Hon. HENRY WALDRON, *of Michigan, Chairman.*

“ AARON A. SARGENT, *of California.*

“ NATHANIEL P. BANKS, *of Massachusetts.*

“ WORTHINGTON C. SMITH, *of Vermont.*

“ JAMES S. NEGLEY, *of Pennsylvania.*

“ WALTER L. SESSIONS, *of New York.*

“ FRANCIS E. SHOBER, *of North Carolina.*

“ PIERCE M. B. YOUNG, *of Georgia.*

“ CHARLES W. KENDALL, *of Nevada.*

SUB-COMMITTEE ON MINES AND MINING,

APPOINTED

TO TAKE EVIDENCE IN REGARD TO THE SUTRO TUNNEL:

Hon. JAMES S. NEGLEY, *of Pennsylvania, Chairman.*

“ WALTER L. SESSIONS, *of New York.*

“ FRANCIS E. SHOBER, *of North Carolina.*

“ CHARLES W. KENDALL, *of Nevada.*

COMMITTEE OF STATES AND MEMBERS

REPORT OF THE COMMITTEE OF STATES AND MEMBERS

The Committee of States and Members, created by the resolution of the General Assembly of 1901, has the honor to submit herewith its report. The Committee has the pleasure to announce that it has completed its work and has prepared a report which it believes will be of interest and value to the General Assembly. The report contains a detailed statement of the work of the Committee during the past year, and also a statement of the work which it proposes to do during the coming year. The Committee has the honor to recommend that the General Assembly should approve the report of the Committee, and should also approve the recommendations of the Committee.

RECOMMENDATIONS OF THE COMMITTEE OF STATES AND MEMBERS

The Committee of States and Members, created by the resolution of the General Assembly of 1901, has the honor to submit herewith its report. The Committee has the pleasure to announce that it has completed its work and has prepared a report which it believes will be of interest and value to the General Assembly. The report contains a detailed statement of the work of the Committee during the past year, and also a statement of the work which it proposes to do during the coming year. The Committee has the honor to recommend that the General Assembly should approve the report of the Committee, and should also approve the recommendations of the Committee.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of the commission to examine and report upon the Sutro Tunnel, in Nevada.

JANUARY 9, 1872.—Referred to the Committee on Mines and Mining and ordered to be printed.

WAR DEPARTMENT,
January 6, 1872.

The Secretary of War has the honor to submit to the United States Senate and House of Representatives the report of the commission appointed by the President, under act of Congress approved April 4, 1871, to examine and report upon the Sutro Tunnel, in Nevada.

WM. W. BELKNAP,
Secretary of War.

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., January 4, 1872.

SIR: I transmit herewith the report and accompanying papers of the commission appointed under the authority of the act of Congress approved April 4, 1871, "to examine and report upon the Sutro Tunnel, in the State of Nevada, authorized to be constructed by an act of Congress approved July 25, 1866, with special reference to the importance, feasibility, cost, and time required to construct the same; the value of the bullion extracted from mines on the Comstock lode; their present and probable future production; also, the geological and practical value of said tunnel as an exploring work, and its general bearing upon our mining and other national interests in ascertaining the practicability of deep mining."

The report presents the views of the commission briefly and clearly.

Under the head of *importance of the tunnel*, the commission is of the opinion that the tunnel is not a necessity for ventilation or drainage, but that any scheme which promises increased economy in working the mines and rendering valuable the vast amount of now worthless low-grade ores in the Comstock lode, becomes of national importance. Whether the Sutro Tunnel project fulfills this condition of economy depends, in the opinion of the commission, upon the practicability of securing a sufficient water-power from the Carson River, at all seasons, for the reduction of the ores, and upon the efficacy of the methods

employed in Germany and other countries in Europe for the concentration of ores. On the first point the commission has no doubt. On the second it has not been able to obtain the desired information.

On the *feasibility of the tunnel*, the opinion of the commission is in favor of the entire feasibility of the project, so far as its construction is concerned.

The *cost of the tunnel*, the branch and all the shafts, is estimated at \$4,418,329 50 in gold.

The *time of completion* is estimated at three and one-half years, which may be reduced to two and one-third years, if machinery be judiciously employed.

The *value of the bullion* extracted from the mines of the Comstock lode, according to the information the commission was able to gather, is \$125,000,000.

The *present annual production* the commission place at \$15,000,000.

As regards the *probable future yield*, the commission says :

No claim can be made to anything like accuracy, except in the few instances in which ore-bodies are now developed. The commission has already stated its belief in the lode being what is known as a true fissure-vein, or as continuing downward indefinitely in the crust of the earth ; but whether the vein will continue to be ore-bearing cannot be predicted with any degree of certainty. It is a matter of opinion, to be based, however, upon probabilities and the actual results experienced in deep mining in other parts of the world. These, in the judgment of the commission, favor the finding of ore down to the lowest depths that can be reached ; and that this opinion is shared by most of the mining authorities, seems to be shown by their continued downward search.

The report concludes with the opinion that, as an exploring work for deep mining, the Sutro Tunnel may justly claim favorable consideration.

The information to be obtained from an examination by a commission of the methods followed in the mines of Germany and England, appears to be of such importance as to recommend itself to the favorable consideration of Congress.

Very respectfully, your obedient servant,

A. A. HUMPHREYS,
Brigadier General and Chief of Engineers.

The Hon. the SECRETARY OF WAR.

REPORT OF THE SUTRO TUNNEL COMMISSION.

OFFICE SUTRO TUNNEL COMMISSION,
New York, December 1, 1871.

GENERAL: I have the honor to forward herewith the report of the Sutro Tunnel commission, and in separate packages, the following:

Package containing maps, plans, and drawings, marked from 1 to 11, inclusive.

Package containing estimate, circular letter, reports of superintendents of mining companies, &c., marked from A to L, inclusive.

The special information asked for by Mr. Sutro was received in time to be used in making the report ; but the papers which he was requested to furnish, inasmuch as the opponents of the project had been invited to do the same, has not come to hand. It may be expected daily, and

when received will be forwarded with request that it be added to the papers accompanying the report.

Very respectfully, your obedient servant,

H. G. WRIGHT,

*Lieutenant Colonel of Engineers, Brevet Major General,
Senior Officer of Commission.*

Brigadier General A. A. HUMPHREYS,

*Chief of Engineers, United States Army,
Washington, D. C.*

OFFICE SUTRO TUNNEL COMMISSION,
New York, November 30, 1871.

GENERAL: The commission appointed under the authority of the act of Congress approved April 4, 1871, "to examine and report upon the Sutro Tunnel in the State of Nevada," having completed the duties assigned to it under said act, has the honor to submit the following report:

The members of the commission met in this city, in pursuance of your instructions, on the 9th of June, and after organizing and making the necessary preliminary arrangements, including a visit to, and examination of the Hoosac Tunnel in Massachusetts, proceeded to Nevada, arriving at Virginia City on the 29th of that month, and at once entered upon the duties with which they were charged. From that date to the 7th of August the commission was constantly occupied with its investigations, during which period it examined pretty thoroughly the mines on the Comstock and other lodes in the vicinity, the country in the neighborhood within a general radius of fifteen miles, with a view to ascertaining its topographical and geological character, and conferred with the mining authorities, miners, and others interested in the great and almost sole industrial interest of that section of Nevada.

Every facility was afforded the commission by the mining authorities and the people generally; the desire seeming to be on all hands to give the opportunity for a full and complete investigation of a subject in which the entire community was so deeply interested. To the superintendents of the various mines the commission is especially indebted for the large mass of information afforded by them, both verbally and in writing, in relation to the mines under their control. The latter portion will be found in their reports in the appendix, made in response to the interrogatories of the commission, a copy of which is also appended. To those papers frequent reference will be made in the course of this report. Mr. Sutro, the projector of the tunnel, was also present during most of the time the commission was in Nevada, and was always ready to afford information, and, from his familiarity with the subject, to suggest ready means for obtaining information from other sources.

The duties of the commission, as prescribed by the law under which it was appointed, were, "to examine and report upon the Sutro Tunnel, in the State of Nevada, authorized to be constructed by an act of Congress approved July 25, 1866, with special reference to the importance, feasibility, cost, and time required to construct the same; the value of the bullion extracted from the mines on the Comstock lode; their present and probable future production; also, the geological and practical value of said tunnel as an exploring work, and its general bearing upon our

mining and other national interests in ascertaining the practicability of deep mining."

To the above points the investigations of the commission, although naturally embracing a wide range, were particularly directed, and to them this report will be strictly confined, treating of them in the order in which they are given in the act above quoted.

IMPORTANCE OF THE TUNNEL.

In treating of the importance of this work, it seems proper to give a brief general description of the Comstock lode, referring for an account of its geological character to that part of the report which treats of the "geological and practical value of said tunnel as an exploring work."

The term *lode* is applied to "any regular vein, whether metallic or not, but commonly to a metallic vein," and will in this report be considered as applying to that fissure in Nevada which traverses Virginia City and Gold Hill, and is generally known as the "Comstock." This fissure or rent in the earth has an extent not yet fully developed, but which reaches certainly from the Ophir mine on the north to the Uncle Sam and Overman on the south, a distance of 12,000 feet. Beyond these points the lode is supposed to extend to the north and south to the Seven-mile Cañon in the former direction, and to the American Flat in the latter. It may, therefore, be said that while the fissure itself is believed to have been traced from the diggings known as the Utah mines on the north to the locality known as the American Flat or "American City" on the south, a length of about 22,000 feet, yet the portion of the lode now worked is comprised between the Ophir on the north and Overman on the south, or a distance of about 12,000 feet, or, say, two and one-quarter miles. This portion of the lode may, as is usually done, be divided into three groups, the "Ophir," the "Gould & Curry," and the "Gold Hill." The two former may be considered as within the limits of Virginia City, the last being in the town of Gold Hill; the two towns being, however, so connected that the stranger is at a loss to determine where one ends and the other commences. Both of these towns rest absolutely upon the lode, and the mine-shafts rise directly in the midst of the streets and houses. The lode has a dip or angle of inclination to the east of about 45° , varying in either direction some 10° . This variation, as might be expected, often occurs within small limits of extent of the vein, but generally keeps within those of 38° and 55° of inclination to the horizon.

The croppings or surface indications of the lode are generally west of the towns of Virginia City and Gold Hill, which, as before remarked, are in most part over the workings of the lode.

In the earlier days of mining upon the Comstock, the work was prosecuted to some extent by means of adits or horizontal tunnels; but as depth was attained, this process was necessarily abandoned owing to the configuration of the country immediately about it, and working by means of vertical shafts was exclusively followed. All the mines of the lode now worked are operated in this manner—that is, a vertical shaft is sunk in the "east country" rock, which, at a depth that can be pretty closely estimated, will reach the lode, and after passing through it into the "west country" rock, is generally continued in the latter upon an angle corresponding with the inclination of the west wall at the point of junction. From these shafts at various depths or "levels," usually about 100 feet apart, drifts or small tunnels are run horizontally in various directions through the lode to ascertain its ore-bearing char-

acter; and through them the ore and débris are brought to the shafts and raised to the surface by steam-power. The water met with in the workings is pumped to the surface through these shafts by the agency of the steam machinery, and air for ventilation is forced by blowers down the shafts, through wooden boxes, and distributed through pipes to the various working headings.

The ore thus brought to the surface is taken from the "dumps," in which it is first deposited, by wagons or railway-cars, and transported to the mills for reduction. These mills are scattered over the country wherever water is to be found, the greatest distance being about eighteen miles. With the exception of those on the Carson River, which are run by water-power, these mills are worked by steam; the water to be obtained being sufficient for the purposes of reduction only, and not for power. Indeed many of these steam-mills were idle during our visit, for the want of water, and the water-mills on the Carson River were generally working up to a part only of their capacities for the same reason.

In the early days of mining on the Comstock lode, several excellent wagon-roads of easy grades were constructed, leading to the mill-sites and to the sources of supply of the lumber and the fuel needed in the working of the mines; but these are now in a great degree supplanted by a railroad recently constructed from Virginia City to Carson City, passing through Gold Hill, and having branches leading to the principal reduction-works. By this road a large part of the ore extracted from the mines is transported to the mills, and most of the lumber and wood used for mining purposes is brought back on the return trips. This road, which is a fine example of railway engineering over a difficult country, is about twenty-two miles in length, not including its branches, and is reported to have cost about \$2,000,000. It is about to be connected with Reno, a station on the Central Pacific Railroad, by an extension from Carson City to the latter point, but at the time of our visit its principal business was the transportation of ore from the mines to the mills, and of lumber and fuel for the supply of the mines.

One of the objects of the tunnel, as will be seen further on, is to change almost wholly the mode of working the mines just described. The tunnel, which is to be nearly rectangular in cross-section, having a height of 12 feet, with a width at bottom of 14 feet, and at top of 13 feet, commences at a point in the valley of the Carson River, and running in a direction nearly perpendicular to the Comstock ledge, is to intersect it at a level of 1,898½ feet below the point of the croppings, marked A on the map, to which the various levels of the mines are referred. At or near this point of intersection a cross-tunnel of similar dimensions is to run along the ledge, and to communicate with all the mines. A commencement of 70 feet only in length has been made on the main tunnel, more with a view to showing what is designed than for any other purpose, and a drift six feet by seven in cross section had been extended under the intervening mountains about 2,300 feet at the time of our visit. It is understood that this length had been increased to 2,530 feet on the 14th of November. The map No. 1, herewith, of the country in the vicinity of the Comstock, shows the positions and directions of the main and cross tunnels, and the sheet marked No. 2, a section and profile of the grounds on the line of the tunnel. The cross section of the tunnel and of the drift or preliminary tunnel, upon which work is at present prosecuted, are shown on sheet marked No. 3. The length of the main tunnel will be 19,790 feet, or about three and three quarter miles, and the cross tunnel, if extended only so far as to include

the mines now being worked, about 12,000 feet, or about two and one-quarter miles. Should the ledge north of the Ophir and south of the Uncle Sam and Overman be again worked, the cross-tunnel must be increased in length correspondingly. In our estimates of costs we have considered the main and cross tunnels separately, and have restricted the latter to the limits of the Ophir on the north and the Uncle Sam and Overman on the south. Drawings exhibiting plans of all the mines within the above limits will be found with this report, marked 4, 5, 6, 7, 8, 9, 10, and 11.

The principal advantages of the proposed tunnel in relation to the mines, as claimed by Mr. Sutro, may be stated briefly as follows.

1st. The improved ventilation of the mines, resulting from the current of air which, entering the tunnel at its outer extremity, and passing through it and up into the mines and out at their present shafts, will so cool and purify the heated, stagnant atmosphere of the drifts and stopes as to preserve the health of the miner, and enable him to accomplish a greater amount of labor than would otherwise be possible.

2d. The drainage of the mines above the level of the tunnel—an object which is now accomplished by means of costly machinery and at great expense. On the connection of the tunnel with a mine, the water in the latter would discharge itself without the intervention of machinery and without cost.

3d. A largely increased economy in the working of the mines by taking the ore through the tunnel to reduction works at its mouth, instead of raising the same to the surface and transporting it, often to a much greater distance, to the mills now established.

4th. Its value as an exploring work in cutting at considerable depths several mineral veins or lodes known to exist to the eastward of the Comstock, all of which have been, and at some points continue to be, worked for the precious metals; also, in a geological point of view, in determining the depth at which precious ores will be found in our country in what may be considered as true fissure-veins.

These claims on the part of the advocates of the tunnel will be considered in the order in which they have been stated, with the exception of the last, which can be more properly treated under the head of "the practical value of said tunnel as an exploring work."

VENTILATION.

At the time the tunnel was projected, and the act of Congress of July 25, 1866, was passed, the mines on the Comstock lode were undoubtedly much embarrassed in their operations by the lack of proper ventilation. The atmosphere in their stopes and drifts was hot and stagnant, and any relief, such as was promised by the tunnel, might well be viewed as indispensable by the mining authorities and miners to the further prosecution of their search for the precious metals. A stagnant atmosphere and a temperature of over one hundred degrees might well occasion misgivings of success in their attempts upon the lower and therefore hotter levels. At that time each mine was worked independently of the others, upon its own ground, with its single shaft forming the only communication between its stopes and drifts and the surface. Without the aid of mechanical ventilation, it is not surprising that, at a depth of three or four hundred feet even, the air of the mines should have severely taxed the miner's powers, and induced the belief that further search into the heated bowels of the earth would be impossible,

unless some artificial aid, such as the proposed tunnel promised to afford, should be provided.

But this very necessity for an improved and increased ventilation indicated one of the means by which it might, in a great degree at any rate, be accomplished. The drifts of contiguous mines were connected together, an air current was established down the shaft of one and up the other, passing in its transit through such of the drifts, stopes, and winzes as were between them, thus purifying and cooling the atmosphere in those parts of both. For the portions of the mines which were influenced imperfectly or not at all by the current of air thus established, recourse was had to blowers operated by the steam-power employed in hoisting. By means of these blowers air could be forced through pipes to all parts of the mines not affected sufficiently by the natural ventilation established by the subterranean connection just alluded to. At the time of our visit, the mines were generally well ventilated, and the miners with whom we conversed did not complain; and in the cases in which a more effective change of air was needed, steps were being taken to accomplish it.

It is, therefore, the opinion of the commission that, while the proposed tunnel would increase and improve the ventilation of the mines and possibly dispense with the use of some part of the means for artificial ventilation now employed, it is not a necessity for ventilation. Even with all the aid that the tunnel can be expected to afford, it is the opinion of the commission that mechanical ventilation by blowers, operated by steam or other power, would still be needed at the headings and in the stopes where the air from the tunnel would not penetrate.

According to natural laws as at present understood and received, the air entering the proposed tunnel would pass through it and up the shafts of the mines by the easiest and therefore by the most direct channels, thereby conferring little if any benefit upon the stopes and drifts not in the line of such direct transit. Hence the necessity which is assumed for a continuance of mechanical ventilation for certain portions of the mines after the completion of the tunnel.

And here it may be proper to allude to certain anomalies observed in the ventilation of the mines on the Comstock lode, as well as in mines upon lodes lying to the eastward. According to the received laws of ventilation it would have been assumed that, in the case of two shafts connected at bottom by drifts, the air current would pass down the lower and through the drifts up the higher, and that this rule would be without exception where not influenced by circumstances of situation or artificial causes; that, in the case of a long adit or tunnel, the inner extremity of which was connected with the surface by a shaft, the outer being directly upon the side of the mountain, the current would be through the tunnel and up the shaft. In the former case the current was found to be sometimes in one direction and sometimes in the other, it having been permanently changed in one instance, after the occurrence of a fire in one of the mines thus connected; the down-draught having been through the shorter shaft before the fire, and through the longer ever since. In the latter case, which applies to two tunnels visited by the commission, the down-draught was into and downward through the shafts and out of the tunnels in a very strongly perceptible current. In view, therefore, of these anomalies, it would seem uncertain whether the current of air would pass through the proposed tunnel into the mines and out through the shafts, or the reverse. So far as the ventilation is concerned, it will be of little importance which way the current should pass. Probably the mines would be the

more benefited by its passing downward through them and out of the tunnel than in the reverse direction.

DRAINAGE.

In the early days of mining upon the Comstock, much trouble was experienced from water which accumulated in the mines, and occasioned the necessity for powerful and expensive machinery for drainage. When, therefore, the tunnel was proposed, it was looked upon as an important accessory to further mining operations in affording a ready and effective means of draining the ledge without the recourse to costly mechanical contrivances. It was then assumed, naturally enough, that the lower the depth the greater the amount of water to contend against, and serious doubts appear to have been entertained of the possibility of freeing the mines from water by mechanical means. The construction of the tunnel seemed, therefore, a necessity. But as greater depths were attained it was discovered that the water, instead of permeating the earth to an indefinite extent, was mainly confined to near the surface; that below a few hundred feet it was struck in limited quantities only. It was also discovered that this water, instead of being generally diffused, was collected in pockets bounded by impermeable seams of clay, which, when pierced, had only to be drained to exhaust the supply. As the mining operations have increased in depth, these pockets or reservoirs have become less frequent and formidable, till in many of the deepest the water is not only not troublesome, but is found in less quantity than is needed for the purposes of the mines themselves, thus necessitating the purchase of water from the company which furnishes the same to the inhabitants of Gold Hill and Virginia City, or from other and wetter mines. By reference to the statements of the superintendents, appended to this report, it will be seen that the cost of pumping for all the mines did not, probably, exceed \$150,000 for the past year, and that in some of them there was no water at all. This sum exceeds that arrived at by the commission—viz, \$124,674—which was obtained by taking the costs as given for the mines, so far as reported, and estimating for the others.

Taking, then, the observations of the commission in connection with the statements of the superintendents of the mining companies, we are of the opinion that the tunnel for this purpose alone is not a necessity for the drainage of the Comstock lode. That it will effectively drain all those with which it shall be connected is obvious; but the same result can be attained by present means at less cost—a cost which, moreover, promises to become still smaller as the mines progress in depth.

ECONOMY OF WORKING, ETC.

Under the present system of operating the mines, the ore and the refuse rock are raised to the surface through the shafts by steam-power, the ore being transported to the mills by wagons or by the railroad before alluded to, and the refuse rock deposited at the dumps contiguous to the shafts. The items of expense, as given by the superintendents, vary somewhat, as might have been expected, in view of the different circumstances in each. The average of certain of the more important of them may, however, be stated with sufficient accuracy, as follows:

Cost per ton of hoisting from depths varying from 1,250 to 1,750 feet, being the average reported for seven of the principal mines of the lode	\$0 51.17
Cost of pumping for the year ending June 30, 1871, as arrived at by the commission, by taking the cost of the mines as far as reported and estimating for the rest	124,674 00

The superintendent of the Ophir mine, a very intelligent man, estimates the total cost for pumping on the Comstock lode for the past year as not exceeding..... \$150,000 00

If we assume what appears from the reports and from other sources as an average yield of the mines—viz: 365,600 tons annually—the cost for certain items of expense by the present method of working will be as follows:

Hoisting 365,600 tons of pay ore, at 51.17 cents.....	\$187,077 52
Transportation of same to mills, at \$1 50.....	548,400 00
Pumping for last year, (commission's estimate).....	124,674 00
Hoisting and lowering 3,000 miners, at 8 cents each way, or 16 cents each.....	175,000 00
Total.....	<u>1,035,151 52</u>

In the above statement the cost of hoisting the refuse rock from the drifts, winzes, &c., is not included, as the quantity is wholly indeterminate, being the greatest in those mines where prospecting alone is being carried on, and the least in those which are working upon ore bonanzas. Indeed, in the latter the amount of débris is inconsiderable. It would be of the highest importance to a full and accurate comparison of the cost of working the mines by the present method and by the tunnel, to introduce this item, as it is very considerable, and the expenditure per ton for hoisting it is the same as for ore; but this seems quite impossible, owing to the indefiniteness of the quantity of refuse removed from the mines.

In considering the cost of operating the mines by the tunnel, it must be stated that, under the provisions of the act of Congress approved July 25 1866, the tunnel company is authorized to collect from all the companies mining upon the Comstock lode a royalty of \$2 per ton for each and every ton of ore taken from the mines after the tunnel shall be connected with them, whether the tunnel be used by the mines or not; that a tariff of 25 cents per ton per mile (or such lesser sum as may be agreed upon) for the transportation through the tunnel may be established; also a charge of 25 cents each way for every man connected with the mines who is carried through the tunnel. The cost of working the mines through the tunnel, as compared with the same items as given above for working by the present method, may then be stated as follows:

Lowering 365,600 tons pay-ore to tunnel level, at 10 cents.....	\$36,560 00
Transportation of same an average of five miles, at \$1 25.....	457,000 00
Transportation of 3,000 workmen, at 50 cents=\$1,500 per day.....	547,500 00
	1,041,060 00
To this should be added the royalty of \$2 per ton, which for the average production of 365,600 will amount to.....	731,200 00
Which makes a total of.....	<u>1,772,260 00</u>

The item of drainage is not included in the above, as the tunnel will thoroughly drain all the mines connected with it without cost. This is not a favorable showing for the economy of working by the tunnel, but it should be stated that while the act of Congress authorizes the tunnel company to make a charge of 25 cents per ton per mile for transportation of ore, rock, débris, &c., it is claimed by Mr. Sutro that such transportation can be done profitably at 10 cents per ton, and that no higher tariff will be demanded. It is also understood that a similar diminution will be made in the charge for transportation of workmen.

Such reductions in tariff would make a material change in the estimate given above, which would then stand as follows:

Lowering 365,600 tons pay-ore to tunnel level, at 10 cents	\$36,560
Transportation of same an average of five miles, at 50 cents	182,800
Transportation of 3,000 workmen at 20 cents, or \$600 per day.....	210,000
	<hr/>
Royalty on 365,600 tons ore, at \$2	438,360
	<hr/>
Total.....	1,169,560

Even with this reduction in tariff, the balance would be against working through the tunnel when the royalty, which is the most important item, is included, (at lower levels the comparison would be more favorable;) and were there no other considerations to be taken into account, the opinion of the commission would necessarily be against the tunnel in the point of economy of operating the mines.

Before presenting these other considerations it should be stated that not one of the superintendents of mines has expressed himself in favor of a change in the present mode of working; and that some of them have given the opinion, in effect, that should the tunnel, when completed, with all its drifts and branches, be offered free of charge, not one mine on the Comstock would be operated through it, for the reason that the present mode of working would be cheaper and more expeditious. This opinion is, no doubt, founded upon the supposition, as it is indeed stated in one of these reports, that the ore taken through the tunnel to its mouth is afterward to be transported to the present mills, thereby involving a cost for transportation about equal, perhaps, to what is now paid for carrying the ore from the mouths of the shafts to the mills. Were the present mills to be employed for the reduction of the ore brought out through the proposed tunnel, this opinion would, no doubt, be correct, and the tunnel project would have to be condemned. But it is a part, and an essential part, too, of the scheme to have reduction works at the mouth of the tunnel, to be operated by the water-power of the Carson River, by which the cost of the further transportation of the ore alluded to above will be saved. This plan, which is one of the considerations to which we have referred, would involve the suppression of the present mills, or at any rate such of them as now draw their supplies of ores from mines which would use the tunnel, and also seriously injure financially the railroad leading to Carson City, which was built for, and mainly depends upon, the carrying of the ores to the reduction works. So far as the milling interests are concerned this would be of comparatively small consequence, and the machinery requires renewal in large part every two or three years, and the mills would be maintained in the interval with a view to their abandonment on the completion of the tunnel or to the transfer of their machinery to new sites at its mouth. To the railroad, however, the results would be more injurious, as the interests outside of the transportation of ore, timber, and other supplies for the mines, would probably not be sufficient for its maintenance. How far these injuries to vested interests should influence action in regard to the construction of the proposed tunnel, is not for the commission to determine. It is clear, however, that the successful working of the tunnel would have an effect upon the railroad similar to that which the latter has produced upon the very excellent and costly wagon-roads which were constructed to facilitate transportation in the earlier days of mining upon the Comstock.

As has been stated, the tunnel project includes, as an important and,

indeed, inseparable adjunct, the establishment of mills at its mouth, for the reduction of the ore; and in order that these should be separated cheaply and successfully, a sufficiency of water-power is necessary. Water, to some extent, may be counted upon from the drainage through the tunnel, a quantity sufficient, perhaps, for purposes other than motive power, but not for running the mills, the power for which, supposing water only is to be used, is to be had from the Carson River alone.

This stream, which has its sources in the Sierra Nevada Mountains, and is fed almost entirely from its melting snows, is not at all times to be depended upon in its natural condition for a supply of power. Art is here necessary in aid of nature. At certain seasons of the year this river becomes a rushing torrent, overflowing its banks and covering its valley opposite the mouth of the tunnel for a considerable extent; at others, it is reduced to a comparatively insignificant rivulet. When the commission was in Nevada, it was represented to be at about its lowest stage, and all its water, when led into the flumes, was insufficient to run the mills established along its valley to their full capacity.

In carrying out fully that part of the project which requires the establishment of mills at the mouth of the tunnel, it will, therefore, be necessary to secure by artificial aid an adequate supply of water for running them at all seasons of the year—at those times in which the flow is insufficient, as well as those in which the supply is far beyond what is necessary. This, it is believed, may be accomplished by the construction of a high dam across a narrow gorge of the Carson River, some five miles above the mouth of the tunnel, which, by damming back its waters, shall form a lake or reservoir that will afford a supply during all seasons of the year, for operating all the mills required for reduction of the ore which can be taken from the Comstock and from the other lodes which may be intersected by the tunnel. That this can be accomplished, the commission does not entertain a doubt; yet it should be understood that this opinion is based upon observation alone, and not upon its actual survey. It should be here stated, by way of explanation of the reasons why the commission did not institute surveys for ascertaining exactly all the points involved in this connection, was that it did not come within the original project of the Sutro Tunnel scheme, and its importance was not so clearly seen while the commission was in Nevada, as it is at the writing of this report, when the various data, upon which many of its conclusions are founded, have been fully examined and compared. The opinion we have expressed is, however, borne out by the rather imperfect examinations made since our visit by the tunnel company, through the agency of the surveyor general of Nevada. The commission is, however, of the belief that his results are less favorable to the project than a more detailed survey would have shown. The report of the surveyor general, furnished by the tunnel company to the commission, will be found in the appendix.

But should the foregoing be practicable, it still seems necessary to the economical working by the tunnel, as against the present mode of operating the mines, that an improved system of concentration of ores should be established. It is claimed by the advocates of the tunnel that, with an abundant supply of water, concentration works may be put up after the methods followed in the mining regions of Germany and England, by which the refuse matter may be mechanically separated from the valuable ores, so that only one ton in fifty, perhaps, need be subjected to the process of reduction for securing the precious metals. According to the accounts received of the workings of the German mines, ores assaying less than \$5 per ton are mined with profit, and that

in the English mines, in Cornwall, one is worked which produces only three ounces of silver, or say \$3 90 per ton of ore, and two others which yield six ounces and ten ounces respectively, and all at a profit, through improved methods of concentration. The commission has exercised much diligence toward ascertaining the actual facts in regard to these statements, as they are of the highest importance in connection with the question under consideration; and it has visited the Passaic mine, at Franklin, New Jersey, and the Lehigh mine, near Bethlehem, Pennsylvania, where machines, claimed to be constructed after the models employed in Germany and England, are used in the concentration of the ores of zinc, but has found nothing that is applicable to the concentration of the ores of the Comstock lode.

The loss of precious metals in the reduction by the German and English methods is represented to be not exceeding 5 per cent., while in Nevada it is not far from 35 per cent. in milling, with a saving of perhaps 10 per cent. more in the subsequent workings of the tailings and slimes, making less than 75 per cent. in all. The actual loss in reduction, therefore, appears to be more than 25 per cent., which for a production of \$15,000,000 per annum, entails a loss of the precious metals exceeding five millions of dollars, or a loss beyond what would result from the methods referred to, by which 95 per cent. is saved, of at least four millions of dollars annually.

It would appear to be very singular that this saving should not be made in the working of the most important mines in our country, if the statements just referred to are reliable. But it is denied by some of the mining authorities upon the Comstock that this statement is correct, and it was asserted that large sums had been offered in vain for producing like results. Indeed it seems quite impossible, from the information we have been able to obtain, to speak positive upon the subject. A personal examination of the foreign mines referred to by one or more competent individuals is the only sure mode of ascertaining the actual facts, as applicable to the treatment of the ores of the Comstock. Yet some better mode of reduction than is now practiced in Nevada may undoubtedly be devised, which shall secure a part at least of the large amount now lost in the separation of the precious ores from the refuse matter.

Still another consideration appeals strongly for this economy in the working of the ores—in the saving of a large percentage of metal now lost in reduction. Of the bodies of ore, other than those of low grade, now known to exist in the Comstock, the greater part will be worked out before the tunnel will be completed. Whether other bodies will be discovered is a matter of conjecture. That the lode is a true fissure vein is, in the opinion of the commission, beyond question. But whether the vein will continue to be metal-bearing to indefinite depths cannot be stated with any degree of certainty, though, in the opinion of the commission, the weight of reasoning and the experience in mining in other parts of the world largely favor such continuance. But, supposing that no further deposits of the precious metals should be discovered, the tunnel, if constructed, would have to depend upon the working of the large bodies of low-grade ores, which have thus far been passed over as unprofitable under the present expensive system of mining and reduction. That such ores exist in large quantities in the mines, containing from eight or ten to twenty-five dollars per ton, is generally admitted, and seems to be undeniable. Only one of the mining superintendents with whom we conferred doubted this, and his opinion, we are satisfied from other testimony, is erroneous. Ores milling less

than about \$20 per ton, or assaying less than about \$30, cannot be mined with profit under the present imperfect process of reduction and the high price of labor which prevails in the mining districts of Nevada. Economy must, therefore, be sought for before the immense amount of low-grade ores can be profitably worked; and this economy is to be found in improved modes of reducing the ores, including concentration; in the general application of water-power, and in the more general substitution of machinery for manual labor, rather than in a reduction of the present rates of wages. A saving of 95 per cent. of the gold and silver contained in the ore, as is asserted to be the case in the German mines of similar character to the Comstock, would go far toward giving value to the millions contained in the low-grade ores which have been thrown aside or passed over as worthless. While it is not assumed that mining can be carried on as cheaply here as in Europe, owing to the higher value of labor in our country, it is not seen why, in other respects, the cost to us should be greater, provided we adopt the same or improved means in the reduction of the ores. If, therefore, ores assaying but \$5 per ton can be there mined and reduced at a profit, we do not see why ores of the same character assaying \$10 may not be profitably worked with us, with our higher rates of labor. This would render valuable the vast amount of now worthless low-grade ores in the Comstock, and add millions to the world's circulation. Hence the importance to the nation of any scheme which promises increased economy in the working of mines.

Whether the Sutro Tunnel project fulfils this condition of economy depends, in the opinion of the commission, upon the practicability of securing a sufficient water-power from the Carson River, at all seasons, for the reduction of the ores, the possibility of which, though not fully proved by accurate surveys, no doubt is entertained, and upon the efficacy of the methods employed in Germany and other countries of Europe for the concentration of ores, of which we are unable to vouch.

Assuming the correctness of these two points, of abundant water and of concentration of ores, we would express an opinion favorable to the tunnel and its accessories as an economical mode of working the mines of the Comstock; otherwise, we should advise that the mines continue to be operated as at present practiced.

FEASIBILITY OF THE TUNNEL.

Of the practicability of the project there is no doubt. It is a question of cost alone. So many tunnels have been run in this, as well as in other countries, through material much more difficult, that no reasonable grounds exist for questioning the feasibility of the one we are considering. So far as surface indications are to be relied upon, the rocks to be penetrated do not differ materially from those which are met with in the operations on the Comstock, in the shafts, drifts, and winzes which have been opened in those mines in the search for the precious metals. While it is quite impossible to predict with any degree of certainty exactly what kinds of rock will be met with in the progress of the tunnel, or in what proportions, it is safe to assume that nothing will be encountered which will offer any serious obstacle to the miner. We, therefore, dismiss this portion of the investigation with the expression of the opinion of the commission in favor of the entire feasibility of the tunnel project, so far as its construction is concerned.

COST OF THE TUNNEL.

In making the estimate of cost, the commission has been governed mainly by costs of shafts and drifts in the mines on the Comstock, and by the actual expenditures as reported by the tunnel company in running its preliminary tunnel or drift, which, as has been stated, has already penetrated over 2,500 feet under the mountains lying between its mouth and the lode. Taking all these elements of information into consideration, an average of cost per foot of length has been deduced, which, in the judgment of the commission, is as reliable as any that can be arrived at for an estimate for a tunnel which is to run for so great a length through rocks, the character of which can only be judged of, and then only imperfectly, by surface indications. This cost, which is given for the main tunnel and its shafts separately from that of the cross or branch tunnel, is:

For the main tunnel and four shafts.....	\$2,707,595 15
For the branch tunnel and two shafts	1,710,734 35
Total in gold.....	<u>4,418,329 50</u>

This estimate, the details of which are given in the appendix, embraces all the expenditures supposed to be necessary for the completion of the work, including machinery, fuel, shelter, superintendence, &c. It is but proper to remark, however, that its correctness will depend in a large degree upon the character of rock met with, and may be either too large or too small as the difficulties shall be found to exceed or fall short of the supposition upon which the estimate is based. The prices stated are in gold, which is the only basis of value recognized in Nevada.

TIME REQUIRED FOR THE CONSTRUCTION OF THE TUNNEL.

Our estimates are based upon the progress made in the shafts and drifts in the mines of the Comstock lode, and also upon the actual progress in the construction of the preliminary tunnel so far as it has been prosecuted, all of which have been executed by manual labor. Under this supposition of progress it will require 1,186 days, or about three and one-fourth years, for the completion of the main tunnel after the work shall have been fairly commenced at all the shafts; and if the cross or branch tunnel be commenced at the same time, as it may be, and pushed forward correspondingly, the whole may be completed in nearly the same time; that is, in about three and four-tenths years after vigorous operations shall have been undertaken upon all parts. But if machinery be judiciously employed, there seems to be no doubt that the tunnel may be completed in two and three-tenths years. Considerable attention has been given to the subject of the application of machinery to this object, resulting in the conviction that the time needed for the completion of the tunnel, beyond what would be required if manual labor alone were employed, may, by its use, be shortened at least one-third.

THE VALUE OF THE BULLION EXTRACTED FROM THE MINES ON THE COMSTOCK LOPE.

To ascertain with perfect accuracy the total value of the bullion extracted from the mines of this lode is quite impossible, owing to the almost total absence of records during the early days of mining. The

commission has, however, obtained a statement of the bullion sent by express, by which it has been mainly transported, amounting for the ten years from 1861 to 1870, both inclusive, to \$123,607,278; and it is the opinion, of those well informed upon the subject, that the product of the mines previously to 1861, including bullion taken away by private parties, will swell the total production, from 1859 to 1871, to \$125,000,000.

PRESENT AND PROBABLE FUTURE PRODUCTION.

The mines which are now productive are given below, with the amount of bullion for the last year so far as ascertained; all the other mines on the ledge being engaged in prospecting only:

1. Savage.....	\$818,216 50
2. Hale & Norcross.....	1,632,500 03
3. Chollar Potosi.....	3,455,423 08
4. Yellow Jacket.....	2,000,000 00
5. Kentuck.....	Not reported.
6. Crown Point.....	Do.
7. Belcher.....	Do.

The present annual production may, it is believed, be taken with sufficient accuracy at \$15,000,000.

As regards the probable future yield, no claim can be made to anything like accuracy, except in the few instances in which ore-bodies are now developed. The commission has already stated its belief in the lode being what is known as a true fissure vein, or as continuing downward indefinitely in the crust of the earth; but whether the vein will continue to be ore-bearing cannot be predicted with any degree of certainty. It is a matter of opinion, to be based, however, upon probabilities and the actual results experienced in deep mining in other parts of the world. These, in the judgment of the commission, favor the finding of ore down to the lowest depths that can be reached; and that this opinion is shared by most of the mining authorities seems to be shown by their continued downward search.

Some few of the mines, as the Crown Point, Belcher, Hale & Norcross, and Yellow Jacket, have ore enough in sight to occupy them for three or four years to come; others, like the Savage, will exhaust all known bodies in a shorter time, while others still will have to depend for their future upon the success of the prospecting in which they are engaged, or upon the low-grade ores which have been passed over or thrown aside as not paying for the cost of working; this last involving the necessity for a large economy beyond what is now practical in the working of the mines and in the transportation and reduction of the ores.

ON THE "GEOLOGICAL AND PRACTICAL VALUE" OF THE SUTRO TUNNEL "AS AN EXPLORING WORK."

In view of the limitations contained in the law, the commissioners confined their geological investigations to the line of the tunnel and its immediate vicinity.

To the works of Baron Richthofen, who devoted many months to a careful examination of the rock formations of the Washoe district; to Professor Whitney, who determined by barometrical measurements the elevation of the mountains and valleys, and determined the geologic age of the deposits near Dayton; and, finally, to the able report of Mr. Clarence King, recently issued from the Government press, we acknowl-

edge our obligations. With the extended labor of these gentlemen on the general geology of the country, it is not a subject of regret that economic geology, with its special application, forms the limit of our investigation.

The entire region in the vicinity of Virginia City gives the evidence of an extensive dynamical disturbance, continued through a long period of time with more or less activity. Volcanic action to an extent and of an intensity not met with in modern times, has played an important part in the formation of numerous mountain peaks, and in giving to the scenery a broken and rugged aspect, which is heightened by the sterility of the soil. Without a tree or shrub to relieve the eye, excepting the sickly-looking artemesia or sage-brush, struggling for existence, the broken and jagged trachytic rocks impart a character of wilderness to the country, and the name of "Devil's Gate," given to one of the passes, indicates the feeling which prompted the first rude settlers to bestow such a name to the rugged scenery. Passing from Virginia City eastward for a distance of four miles in a right line, we reach the comparatively fertile valley of the Carson, while within the range of vision to the northward the sand clouds may be seen sweeping over the desert region known as the Sink of the Humboldt. We do not design giving a full topographical description of this interesting but sterile country, but desire to convey the idea of the worthlessness of these mountains except for the boundless wealth in minerals which they contain.

The various ages and modes of deposit of the rock formations have an important practical bearing, and require our special attention.

Mount Davidson, from its height and position, as well as from its lithological character, was the first to make its appearance amid the snow mountain peaks of the Washoe district. It is a syenitic rock, compact in structure, difficult to work, and bears important relations to the Comstock lode, forming the west wall for a considerable distance, if not through its entire extent. The elevation of Mount Davidson has been determined at 7,827 feet, its summit rising 1,622 feet above Virginia City, and has a range of outcroppings of quartz rock skirting its eastern side some 1,500 feet below its summit.

To the eastward on the line of the proposed tunnel are numerous hills, intersected by valleys or deep ravines, extending to the plains of the Carson River.

Next in order to the syenite is an extensively diffused volcanic rock called propylite, which was spread over the entire portion of the tunnel section. This is the green-stone or "green-stone trap" of the miners, and works with great facility. It is thickly studded with fine granules and occasionally with distinct crystals of sulphuret of iron. It is important as furnishing the eastern or hanging rock of the Comstock lode.

Through the propylite, at a later period, volcanic craters have been opened, and formed by their ejections hills or mountains of considerable elevation, varying much in their color, compactness, and the circumstances attending their formation. The most common variety of this trachytic rock is a simple greyish, pasty mixture, with its particles loosely cemented together, easily worked with the pick, except at considerable depths, when it becomes compact and is useful as a building-stone. The structure of the rock indicates that the volcanic ashes of which it is composed were ejected in connection with water or steam and cooled rapidly after its deposit. The mud volcanoes of Western Mexico furnish a type of this form of deposit. Another variety of the same color, with numerous crystals of glassy feldspar diffused through its mass, from which it has received the name of sanadin trachyte, was deposited

in a similar manner, but cooling slowly gave an opportunity for the play of chemical affinities, by which the crystals were formed, and a more compact structure of the rock resulted.

A third variety, with a color ash grey, or of a more or less deep red color, is found one and a half miles from the mouth of the tunnel. With the same chemical constituents, except the addition of oxyde of iron, we have in this a firm, hard rock, working with difficulty.

Still another variety of considerable practical importance is met with, which has been passed through for a distance of 750 feet at the commencement of the tunnel, which may be distinguished under the name of trachytic conglomerate. It is characterized by numerous angular masses, sometimes of great size, cemented together by the ash-colored trachytic matter, and offering to the drill and giant powder serious obstacles to rapid progress in the work of constructing the tunnel. This formation is due to the breaking down of the walls of the crater and the projection of their broken up, angular masses into the ashy deposits from the volcano. These walls were, at this place, composed of metamorphic porphyry, the fragments of which are now held together firmly by the cementing material.

Numerous recent instances might be cited for illustrating the action of ancient volcanoes, the same laws which governed in former times being operative at the present, but with far less intensity.

In 1813 a volcanic eruption of ashes occurred on the Island of St. Vincent, which fertilized the Island of Barbadoes, the ashes falling in Bridgetown to a depth of several inches. The amount of material thrown out must have been immense, as the transfer was made in opposition to the trade-winds.

The once beautiful and symmetrical volcano of Consaguina, in Central America, some forty years ago exploded with a report heard at Santa Fé de Bogota, a distance in a right line of one thousand eight hundred miles, and emitted ashes in such quantities that, for hundreds of square miles, the sun was obscured, and for ten days made a midnight darkness over most of Honduras and San Salvador. The ruins of Pompeii and Herculaneum furnish us with well-known examples of similar volcanic eruptions.

The other formations on the line of the tunnel are of much less consequence in this connection. At the St. John's mine, on the Monte Christo lode, is a deposit of granular limestone, which disappears at some 200 feet in depth where the propylite is in place.

Andesite, a hard hornblendic rock, caps one of the hills near the route of the tunnel. This is of volcanic origin, and is only less hard than obsidian, of which a few scattered specimens were met with.

To recapitulate, we have for a basis the syenite of Mount Davidson, then propylite, (with porphyry,) sanidin trachyte, loosely aggregated, and compact trachyte, trachyte conglomerate, andesite, and carbonate of lime on or near the line of the tunnel.

It becomes a matter of much importance to determine the character of the rock excavation in estimating the cost of construction and the time required to complete the tunnel. The quartzite met with in the Hoosac tunnel has greatly impeded the progress of that great work, causing a weary delay, and leading to great expense in construction. With this example before us for not relying upon surface indications alone for the character of the rock excavation, your commissioners sought every indication possible for obtaining a correct idea of the formations through which the Suto Tunnel will be required to penetrate. We were still more strongly impressed with the necessity for using great

precaution in our determinations, as unexpected results had already been obtained in the portion of the tunnel or heading which had been driven some 2,300 feet. The surface indicated that, for this and a much greater distance, the tunnel would pass through trachytic rock only. On the contrary the following results were obtained, viz:

	Feet.
1. Trachytic conglomerate.....	750
2. Trachyte.....	500
3. Trap-dyke.....	40
4. Red clay.....	70
5. Blue clay (<i>porphyritic</i>).....	100
6. Porphyry.....	840

The firmness of the conglomerate will be sufficient to support itself without timbering. All the others will require this support, and the blue clay continually acts upon and crushes the frame-work, requiring constant care and frequent excavations behind the timbers to prevent the complete closure of the adit. This difficulty is encountered in many of the mines, until the clay becomes sufficiently dry to resist the great pressure of the vast body of the same material behind it. No part of the tunnel will cost as much per hundred feet as that passing through this clay.

In an economic view, the porphyry and propylite may be considered the same, having about equal density, and working equally well under the drill. In the former, a greater liability exists of encountering clay seams, as a result of the disintegration of the feldspar, which enters largely into its composition.

With but comparatively slight exceptions, these two formations will be the only ones encountered in the construction of the tunnel, for they underlie the trachytic and other volcanic rocks, and, except in chimneys, these later formations will not be encountered.

The propylite by exposure to moist air too readily disintegrates in consequence of the changes effected in the sulphuret of iron, with which it is filled, and will require to be timbered in consequence. All the circumstances named have been taken into consideration in forming an estimate of cost, and as an element in determining the time required in construction.

By the cooling of the vast field of propylite which had been poured out, we may assume that the contraction was sufficient to cause a vast fissure near or at its junction with the sienite.

The period of active volcanic movement again occurring, there was injected from below a body of quartz in quantity sufficient to fill this fissure. Practically, it does not matter whether this was accomplished by solfataric action or by direct volcanic forces, or whether we consider the metallic wealth deposited in the lode by super-heated steam and the action of acids, or consider that with the siliceous the gold and silver were thrown up by the same force.

We know that for a distance of five miles, with a varying width of from 50 to 500 feet, and to an unexplored depth, the Comstock lode is found one of the richest, most productive and extensive in the records of mining.

It is, however, of very great importance to determine whether the Comstock be a true fissure-vein, as declared by most intelligent geologists, or be but a gash-vein, with its material filled in from adjacent rocks. The permanency of the mining interests of Nevada depends upon which of these views prove correct. In the first contingency we may claim that no true fissure vein has ever been worked out, and from

analogy we may draw the conclusion, with a good degree of certainty, that the Comstock cannot be exhausted by the labor of man. If but a gash-vein, the conditions are so changed that exhaustion must at no distant day be the result. In a careful examination of the rocks near the lode, we do not find a loss of any proportion of the quartz which belongs to them. From whence, then, could this mineral have been derived? Again, the only source of supply by washing in must have been obtained from a higher level, or the syenite of Mount Davidson. This would imply a decomposition of that rock; and the hornblende, one of its constituents, would as readily be carried into the opening as the quartz. The hornblende is not found mingling with the silicious deposit, therefore the latter could not have been received from the syenite.

We are left to the only possible explanation of the occurrence of this wonderful deposit, *i. e.*, that it is a true fissure-vein filled from below, and, like other fissure-veins, extends to a depth beyond the power of man to reach. The explanation of the clay selvages bounding the vein-matter, the formation of "horses" by the falling of portions of the hanging rock, the exhaustion of rich bonanzas or bodies of paying ore, the barren condition of much of the quartz, are none of them peculiar to the Comstock lode, but are met with in other mines of a similar character, and have been fully described elsewhere. The crushed and crumbly condition of much of the vein-matter has been ascribed to dynamical action, supplemented, doubtless, by chemical changes in the sulphurets met with in considerable quantities in the lode. With reference to the future productiveness of the mines, until carefully explored at deep levels, much must be left to conjecture: The mere fact that the Comstock is a true fissure-vein establishes that the vein-matter or quartz extends downward indefinitely, but does not prove that this material is charged with the precious metals. Reasoning from the past history of fissure-veins in other countries, we have just grounds for believing that the metallic wealth, thousands of feet below the surface, will fully equal or be even greater than that from higher levels. The Sampson mine in Germany has reached a depth of 3,000 feet without any diminution of its yield of silver. This, compared with the Comstock, is a small vein, but for that very reason is far more likely to be lost by a fault than one of the magnitude of the lode under consideration.

It is quite probable that at great depths the metals are more equally distributed through the vein matter, in which case the very rich ores will not be met with, but the whole mass will yield an equally favorable result, without the large expenditures required in drifting for bonanzas. The recent discoveries in the Crown Point and Belcher mines of immense bodies of "rich rock" at nearly 1,700 feet below the initial point is a most encouraging feature for the permanent value of the lode.

We had the privilege of examining such portion of the bonanza of the Crown Point as had been uncovered, estimated to be worth \$15,000,000, with a prospect of equal value at a still greater depth. Judging from the present quotations of the Belcher stock, this latter mine should give even greater results than the Crown Point.

One other feature of the recent discovery becomes important to the mine owners and to the country. Upon the upper levels of this and some other mines, if not in all, the yield of gold was greater in value than of silver. As the mining progressed in depth, the silver yield to

the ton of ore became the greater, but in the new discoveries the more precious metal is restored to its previous relative proportion.

An examination of the reports of superintendents give us a much higher per cent. of the gold contained in the ore secured than of silver. In the report of the Savage mine, of this year, we find that the loss in working from the assay value of the ores is, of gold, $25\frac{1}{10}$ per cent., of silver, $34\frac{2}{10}$ per cent. The larger the proportion of gold in the ore, the less absolute loss is made in the working.

The above statement is the result of the workings in the Occidental mill, under the direct control of the Savage Company, and includes all savings from slime and tailings secured to the company.

In the Custom's mills, the report shows a less favorable result on the silver product, as follows: Gold loss, $23\frac{1}{10}$ per cent.; silver loss, 44 per cent.

It may not be out of place to remark that the loss on the gold product is ascribed to "float gold," which might possibly be secured by running the surface-water or "float" through sponges. The loss of silver is due to a failure in the works to secure the sulphuret of silver, and, to a limited extent, to particles of clay, carrying with them minute portions of silver, as suggested in the report of Mr. Clarence King.

It is well understood by all who have given their attention to the subject, that the metallic deposits are not equally diffused through the vein-matter, but are found in detached bodies called "bonanzas." This rule holds good in the Comstock lode as well as in all other silver lodes, having quartz as a gangue. An examination of the mining map, exhibiting the workings of this lode in detail, proves the deposition of the rich ores of the precious metals in *bodies*, and the comparatively barren quartz in other portions.

There is no law yet evolved from experience or science for determining the position of these rich bodies of ore; explorations alone can discover their position and value. It is, however, sufficient to know that they are confined to the vein-matter, and their discovery may be expected so long as we confine our workings within the boundaries of the "country rocks."

By the present system of working the ores from these mines, rock that yields by assay less than \$30 to the ton, cannot be reduced at a profit.

The amount of low-grade ores, ranging from \$10 to \$35 in the Comstock lode, amounts, by the testimony of some witnesses, to millions of tons. The following forms a small portion of the evidence obtained upon this subject: Colonel Requa, superintendent of the Chollar Potosi mine, in his various reports, mentions the large amount of ores that at some future time may be made available to the owners, that with present prices for labor and by the present processes of reduction cannot be utilized. He stated, personally, that very large bodies of sixteen-dollar ore exist in the mine.

A former superintendent of the Empire and Imperial mine stated that while in charge he struck a body of ore that yielded \$19 per ton, which, at the then cost of mining, transport, and reduction, did not pay. This body was prospected in the middle of the lode, more than 100 feet wide, to a depth of 6 feet only. How large this body of ore may be he was unable to state.

Mr. George Atwood, at present superintendent of the Eberhart mine, has worked as foreman, &c., for eight years on various mines of the Comstock lode, states that in the south mine of the Ophir a body of ore exists that has been mined and used for filling in stopes for a distance

of 300 by 300 by 100 feet, which will average, by assay, \$20 per ton. A large body in the north mine, yielding but little less, is found in place. He further states that in the Crown Point, on the 200-foot level, an estimated amount of 100,000 tons of ore, that will assay \$20 per ton, may be found. Was for three years connected with that mine, and is thoroughly acquainted with the upper levels.

From our own observation, and the evidence of others, we do not hesitate in stating that vast amounts of what are designated as low-grade ores abound in these mines, that may yet be made available in increasing the national wealth.

At each extremity north and south from the principal mines the workings are carried on exclusively for gold. The Sierra Nevada Company, the most northerly of the group now in operation, is understood to be profitably engaged in working the loose surface rock and soil. At the other extreme the Succor mine and mill, situated on Gold Cañon, are in operation; the vein of precious metal having been followed into the mountain 1,300 feet, and the ore is taken to the mill direct through a tunnel. The facilities for working and the economy exhibited has saved the stockholders from the usual heavy assessments.

A careful survey of the adit of this mine developed an unexpected fact. Following the windings of the tunnel, which kept pace with the sinuosities of the vein of ore, we reached the same character of quartz rock that had become familiar to us in the mines of the Comstock. This was an accidental discovery of the miners during a search for the gold vein, which had been lost from a fault. This "white lode" assayed \$22 60 per ton. By taking the bearings by compass in this and in the Crown Point mine, they indicated a connection with each other. The theory has been that near the Overman mine the vein or lode bent around to American Flat, where it ceased. Further research may be necessary to establish with certainty the view, that a branch at least of the Comstock lode passes down Gold Cañon and shows itself in the Succor mine, one and a half miles below the Crown Point.

The appearances indicate that the "white lode" and the gold vein will at no great distance unite to form a rich lead, and when thus joined the value of the gold and silver lead will be condensed into the gauge of one with the relative proportions of gold to silver now met with in the Crown Point.

The value of the proposed Sutro Tunnel simply as an exploring work is so evident as to be scarcely called in question. Cutting, as it does, at right angles two or more lodes before reaching the Comstock, that, in Europe, would be deemed valuable; the determination of their wealth or poverty would prevent further ruinous outlays in prospecting. There is no certainty that rich bonanzas will be met with in the progress of the work, but that an abundance of moderately rich ores will be found is quite probable. We found at the Occidental mine, on the Monte Christo lode, two adits or tunnels had been run, one to the distance of 1,850 feet for a considerable distance through crystalline limestone, after which porphyry and then propylite made their appearance as we penetrated the tunnel.

The quartz vein is often broken down and crumbly and colored by oxide of iron. In the limestone excavated we noticed arborescent crystals of manganese. Extensive galleries and wide chambers were met with, from which rock working from \$10 to \$33 had been taken. The upper tunnel had been run for 1,500 feet and connected by a shaft to the lower one. We noticed that the current of air passed down the shaft and out at the lower tunnel. Much of the quartz rock is nearly

or quite barren, but we were informed that millions of tons assaying from \$8 to \$10 to the ton existed in the mine. We believe this to be a fair index of the character of the Monte Christo lode which we visited in other localities. What developments will be made at the great depth at which the tunnel will cross its track is, of course, uncertain. The heading which has been run will, if continued a few hundred feet farther, cut the "Great Flowery lode," with what result we are not prepared to predict.

We made an examination of the Lady Bryan mine, said to be located on this lode. The croppings of quartz rock is enormous in quantity, forming a hill about 100 feet high, and would yield for the whole mass, as we were informed by the superintendent, an average of \$8 per ton of silver.

An open cut has been made through the hill or body of quartz rock into a large basin formed by the excavation of material, some of it valuable, but a large quantity too poor for working.

Short drifts have been run into the hill-sides in various directions, which at the time of our visit were not worked. The richer ores were being assorted for milling, the mine furnishing but eight or ten tons per day of valuable material. Only ten men were employed on the works at the time, the mine having recently passed into new hands.

With reference to the tunnel cutting *blind lodes*, we are not prepared to express an opinion, the very name implying a complete want of knowledge of the subject. The possibility barely exists, with the past history of mining giving strong practical evidence against the probability of a favorable result.

As an exploring work, we think the Sutro Tunnel may claim to determine with sufficient certainty the ore-bearing character of the Great Flowery and Monte Christo lodes, and settle definitely the question whether the Comstock lode at great depths continues in richness; or, as is believed by some, becomes worthless as the deep levels are opened. It is somewhat remarkable, as bearing on this subject, that the Crown Point, once justly esteemed valuable, and ranking high in the stock board, became almost worthless under the supposition that the mine was worked out. By the energy and perseverance of the superintendent, the owners were rewarded by the discovery, at deep levels, of one of the richest bonanzas yet found on the Comstock lode, which sent the stock up from \$2 50 per share to over \$300. It must be borne in mind that at two or three points shafts reaching as low as the tunnel will be sunk by the time of its possible completion. This will not be so complete an exposure of the value of the lode as drifts from the lateral tunnel, made at comparatively small expense, at numerous points along its course.

We cannot but think, therefore, that, as an exploring work for deep mining, the Sutro Tunnel may justly claim favorable consideration.

Respectfully submitted.

H. G. WRIGHT,

Lieutenant Colonel of Engineers, Brevet Major General.

J. G. FOSTER,

*Lieutenant Colonel Engineers, and Brevet Major General,
United States Army.*

WESLEY NEWCOMB,
Civil and Mining Engineer.

Brigadier General A. A. HUMPHREYS,

Chief of Engineers, United States Army, Washington, D. C.

OFFICE SUTRO TUNNEL COMMISSION,
New York, December 2, 1871.

GENERAL: I have the honor to transmit herewith a letter from Mr. Adolph Sutro,* in which he states that he has not been able as yet to prepare the paper which he desired to furnish, relative to the advantages of the tunnel as compared with the present method of working the mines; but he incloses a printed copy of a speech delivered by him at Virginia City, in support of his project, and desires that it may be added to the appendix of the commissioners' report.

This printed speech is also inclosed, and I would ask that it be attached to the appendix of the report, as desired by Mr. Sutro. I would further suggest that his letter be also appended.

Very respectfully, your obedient servant,

H. G. WRIGHT,
Lieutenant Colonel of Engineers, Brevet Major General,
Senior Officer of Commission.

Brigadier General A. A. HUMPHREYS,
Chief of Engineers, United States Army, Washington, D. C.

APPENDICES.

APPENDIX A.

Estimates of cost of the Sutro Tunnel.

Cost of sinking shaft No. 1, 109 square feet area and depth of 530 feet, including tools, labor, and materials of all kinds, at \$40 24 per foot of depth, (being the average cost in the seven principal mines of the Comstock lode).....	\$21,327 20
Same, shaft No. 2, 109 square feet, 1,025 feet deep, at \$40 24.....	41,246 00
Same, shaft No. 3, 109 square feet, 1,319 feet deep, at \$40 24.....	53,076 56
Same, shaft No. 4, 109 square feet, 1,499 feet deep, at \$40 24.....	60,319 76
Same, shaft No. 5, 109 square feet, 1,465 feet deep, at \$40 24.....	58,951 60
Same, shaft No. 6, 109 square feet, 1,465 feet deep, at \$40 24.....	58,951 60

Preliminary tunnels or drifts.

Cost of labor, tools, and materials of all kinds, for drift of main tunnel, 6 feet wide, 7 feet high, and 19,790 feet long, at \$16 90 per running foot, (being the average cost of 2,185 feet completed July 1, 1871).....	\$393,821 00
Deduct value of one-half of timber of drift, which may be used again as the enlargement progresses.....	14,644 60
	379,176 40
Cost of labor, tools, and materials of all kinds, used in drifts of branch tunnel, 6 feet by 7 feet, by 12,000 feet long, at \$19 90 per running foot.....	238,800 00
Deduct value of one-half timber of drifts used a second time.....	8,880 00
	229,920 00
Cost of enlargement of drift to full size of tunnel, 13½ feet by 12 feet, by 19,720 feet long, 2,366,400 cubic feet, at 25 cents.....	591,600 00
Same, of branch tunnel, 12,000 feet long, 1,440,000 cubic feet, at 25 cents.....	360,000 00
Cost of timbering main tunnel full size, 19,720 feet in length, at \$17 34 per running foot.....	341,944 80
Same, of the branch tunnel, 12,000 feet, at \$17 34.....	208,080 00

* See Appendix M.

Cost of general material and sundries, including surveying instruments, large transit building for the same, boarding and lodging houses, barns, horses, carts, magazines, blowers, air-pipes, &c., for four shafts of main tunnel	\$66,439 00
Same, for branch tunnel, two shafts	20,000 00
Cost of hoisting and pumping engines and machinery for four shafts of main tunnel	121,679 00
Same, for branch tunnel, two shafts	108,930 00
Cost of boilers and parts, four shafts, main tunnel	33,736 40
Cost of boilers and parts, two shafts, branch tunnel	25,256 00
Cost of labor and materials for the erection of machinery, and temporary buildings to cover the same, for the four shafts of main tunnel	32,265 00
Same, for the two shafts of branch tunnel	21,510 00
Cost of material and time employed in attending machinery during the sinking of four shafts, main tunnel	138,734 27
Same, for the two shafts of branch tunnel	82,489 50
Same, during the running of the preliminary tunnel of the main tunnel ..	324,784 90
Same, of branch tunnel	216,523 26
Cost of appliances for hauling rock and ore out of main tunnel	50,000 00
Cost of appliances for hauling rock and ore out of branch tunnel	35,000 00
Add for office expenses, superintendence, engineering, and contingencies, 20 per cent.	736,388 25
Total cost in gold	<u>4,418,329 50</u>

RECAPITULATION.

	Main tunnel.	Branch tunnel.
Sinking shafts	\$175,969 52	\$117,903 20
Running preliminary tunnels	379,176 40	229,920 00
Enlargement of drifts to size of tunnel	591,600 00	360,000 00
Timbering full-size tunnel	341,944 80	205,080 00
General materials and sundries	66,439 00	20,000 00
Engines and machinery	121,679 00	108,930 00
Boilers and attachments	33,736 40	25,256 00
Erection of machinery and temporary buildings for same ..	32,265 00	21,510 00
Attending machinery in sinking shafts	138,734 27	82,489 50
Ditto in running preliminary tunnels	324,784 90	216,523 26
Endless wire-rope, &c	50,000 00	35,000 00
	<u>2,256,329 29</u>	<u>1,425,611 96</u>
Office expenses, superintendence, engineering, contingencies, 20 per cent	451,265 86	285,122 39
	<u>2,707,595 15</u>	<u>1,710,734 35</u>

Time required to complete tunnel.

Depth of shaft No. 4, (the deepest)	1,499 feet.
Average daily progress in the shafts of the Comstock	3 feet.
Number of days required to sink shaft No. 4 1,499 feet	500 days.
Whole length of main tunnel	19,790 feet.
Distance penetrated by preliminary tunnel, July 1, 1871	2,185 feet.
Average daily progress in preliminary tunnel	4.15 feet.
Distance penetrated when shaft No. 4 reaches tunnel level	4,260 feet.
Distance remaining to be penetrated at that time	15,530 feet.
Number of available working headings	9
Greatest distance to be penetrated by any drift to meet the drift from the adjacent shaft	2,432 feet.
Time required to run above distance at 4.15 per day	586 days.
Total time required to sink shafts and run drifts	1,086 days.
Additional time required to enlarge tunnel to full size	100 days.
Total time required to complete main tunnel	1,186 days.
Number of years required to complete main tunnel	3¼ years.
Number of feet of branch tunnel run from four headings at bottom of shafts Nos. 5 and 6, 1,465 feet deep, when main tunnel is completed ...	414 feet.
Additional time required to extend branch tunnel to 12,000 feet working two headings	50 days.
Total time to complete main and branch tunnels, (manual labor)	3¼ years.
Total time to complete main and branch tunnels, (by machinery)	2½ years.

APPENDIX B.

*Circular to superintendent of mines.*OFFICE SUTRO TUNNEL COMMISSION,
Virginia City, Nevada, July —, 1871.

SIR: By the act of Congress approved April 4, 1871, this commission is required to report, among others, upon the following points, viz:

1. The value of the bullion extracted from the mines on the Comstock lode.
2. Their present and probable future production.
3. The geological and practical value of said tunnel as an exploring work.

Much of the information required by the above can be obtained only from the companies engaged in mining on the Comstock lode; and as regards the rest, the information which the companies can afford will be of the highest value to the commission in the discharge of its duties. I am, therefore, instructed to request of you your views in writing, upon the points above quoted, as well as upon any others which you may deem to have a bearing upon the question of the construction of the Suto Tunnel.

I also take the liberty, under the instructions of the commission, to append a series of questions having a bearing upon the portions of our duties not enumerated above, your answers to which will be important in making up our estimates of the probable cost of the proposed tunnel, and its value as an aid to deep mining on the Comstock lode.

Should your reply to the foregoing not be ready before the commission leave Virginia City, please forward it addressed to me at the Army Building, New York City. The earliest practicable answer will, however, oblige.

Very respectfully, your obedient servant,

H. G. WRIGHT,
Brevet Major General, Senior Officer of Commission.

To ————,
Superintendent of ——— Mine.

The following are the questions to which answers are asked:

1. Cost at various depths of sinking shafts, estimated by cubic foot removed, or by the running foot for a shaft of given dimensions.
2. The present cost of timbering the same, with increase, if any, with the depth.
3. The cost of drifting in the various rocks met with in your operations; estimated either by the cubic foot or by the running foot, specifying the dimensions of the cross-section.
4. The cost of timbering the same.
5. The daily progress made in the shafts and drifts through the various rocks, the largest force that can be worked to advantage being employed.
6. The cost of ore, water, &c., from various depths.
7. The cost of pumping at your mine for twelve months; preferably for the year ending June 30, 1871.
8. Has the water in your mine increased or diminished with the depth, and in what proportion?
9. The cost per ton of ore for milling; and where the cost of transportation to the mill is included, the cost of the latter.
10. What is the present cost of the artificial ventilation of your mine, and how does it increase with the depth?
11. How long a time at the present progress of working will it require to exhaust all the profitable ore in the mine, above the 600-foot level?
12. How long between the 600 and 1,000-foot levels?
13. At what depth will the present machinery be available for hoisting the ore or clearing the mine from water?
14. What additional expense will be incurred, if any, per 1,000 feet of additional depth for the purposes above named, calculating from the 1,000-foot level?
15. What is the width of the lode and also of productive vein-matter at the various levels of your mine?
16. What has been the expense of prospecting the mine for the year passed?
17. How does the pay-ore compare at each level, from the surface downward?

APPENDIX C.

OPHIR.

OFFICE OPHIR SILVER MINING COMPANY,
Virginia City, Nevada, September 21, 1871.

SIR: In compliance with your communication of July 23, asking my views upon the question of the construction of the Sutro Tunnel, I beg leave to respectfully submit the following:

Answer to congressional question No. 1, the value of the bullion extracted from the mines on the Comstock lode.—Bullion extracted from the Ophir mine since the incorporation of the company, in July, 1860, \$4,631,539 10.

Nos. 2 and 3. Their present and probable future production, and the geological and practical value of said tunnel as an exploring work.

In answer to congressional question No. 3, I will briefly state, as to its geological value, I am not competent to judge; but as to the practical value I will offer a few remarks: First, I will consider its value as an avenue through which all the mines on the Comstock may be worked, as it is claimed by Mr. Sutro that all the machinery on the lode may be dispensed with both for hoisting and pumping, and the entire business of or work of all the mines be carried on through his tunnel. You will please consider the tunnel with all its lateral drifts completed, and all the mines on the Comstock being worked through it. No machinery is used on the surface.

We have, to begin with, (page 19, "Sutro Tunnel,") 3,000 miners to carry to and from their work, an average distance from the mouth of the tunnel of four and a half miles. These 3,000 miners divided into three shifts of eight hours each, gives us 1,000 men on each watch. Allowing ten men to a car, it would require one hundred cars to convey the men into the tunnel. The train would occupy 1,200 or 1,500 feet in length of the tunnel, and when the head of this train would reach the place of destination the rear cars would be quite an inconvenient distance back from the place of destination, thereby creating much confusion and more or less delay. It is at this point that the miners' greatest trouble begins, their respective stopes and places of work being far above them. They commence to climb the ladders, and go up various heights, many from 500 to 1,000 feet. They arrive at the place where their day's work is to be done in an exhausted condition, positively unfit and unable to do a day's work.

The timbers used in the various mines are to be conveyed to their respective destinations by the same tedious, slow, and expensive routes—expensive, because time in this country is money in fact, the most expensive commodity that is employed in the working of these mines.

Suppose a cave is threatened in some one of the most distant or inaccessible mines. A car-load or two of timbers immediately and judiciously used, might, and often does, prevent a disastrous cave. By the present mode of working, in such a contingency as the above, the miner would send his order up, and in a very few minutes the return cage would bring the desired timbers, and in a few minutes more the timbers would be in place, and the threatened disaster averted. How would it be in working through the tunnel? The miner would first give his order for timbers, the order conveyed down the ladder, probably 1,000 feet to reach the tunnel, then out of the tunnel, a distance of four or five miles, to the carpenters' shops at the mouth of the tunnel; the timbers procured and sent by return cars to the foot of the upraise, then raised, by some as yet unexplained process, to the point of danger or trouble.

In this way, hours might elapse before the much-needed timbers would arrive, and then they would probably arrive too late to prevent great damage.

Another disadvantage in working the mines through the Sutro Tunnel is, the mouth of the tunnel being located several miles farther from the timber and lumber supplies, would necessarily increase the cost of the same two or three dollars per thousand more than when delivered at Virginia or Gold Hill.

The foregoing are some of the practical objections to using said tunnel as an avenue through which to work the mines on the Comstock, and as a practical miner of more than forty years' experience in various kinds of mining, I make this assertion, that should the tunnel, with all its lateral drifts, be offered *free of charge*, not one mine on the Comstock would be worked through it. And why? Because the present mode of working is cheaper and more expeditious.

Now I will offer a few remarks regarding the various charges imposed upon the mining companies for the privilege of working through this tunnel. Mr. Sutro (page 166 of his book) estimates the daily yield of all the mines on the Comstock at 1,500 tons. For the right to transport this ore through the tunnel, the mining companies must pay 25 cents per ton per mile, or about an average of \$1 12½ per ton, amounting to \$1,687 50 per day, or \$615,937 50 per annum. There should be added to this a like amount for debris or waste, which, including that from all the shafts, winzes, upraise, and drifts purely of a prospecting character, would be more likely to overrun than fall

below this amount, which gives us \$2 25 per ton, or \$3,375 per day, or the large sum per annum of \$1,231,875.

In addition to this, we have the transportation of the miners, which, as he estimates 3,000 men to raise 1,500 tons of ore, gives us two men for each and every ton of ore, equal to \$1 per ton, or a total thus far of \$3 25 per ton, or \$4,875 per day, or the nice sum per annum of \$1,779,375.

As large as this sum is, we must again add to it the cost of conveying the timbers to the respective mines, which is 25 cents per ton per mile, (40 cubic feet or 480 feet board-measure being reckoned as one ton,) and he estimates the total consumption of timber per annum (page 18) to be 16,000,000 feet, which gives us 33,333 $\frac{1}{3}$ tons; taken at an average transportation distance of four and a half miles, amounts to \$1 12 $\frac{1}{2}$ per ton, or a total for this item of \$37,500; or 6.8 cents per ton of ore, added to the above, amounts to \$1,816,875. And yet we are not quite through, for we still have to add the indefinite amount of 50 cents per head for all superintendents, foremen, their assistants, attaches, and visitors that go in and out of this famous tunnel. Taking Mr. Sutro's estimate, we now have taxes in specified items amounting to \$3 31.8 per ton, and for what? For the privilege of working the mines in a more expensive and less convenient way than the present mode of working them. But thus far there is one redeeming feature in the contract. It is this: it is optional with the different mining companies whether they pay any or all of the before-mentioned tariffs, for if they do not work through the tunnel they need not pay any of them.

We now come to a tax that is more arbitrary in its character. No mine on the Comstock lode can escape its provisions. It is what is termed the two dollars per ton royalty, which is intended to be a compensation for draining the mines, and is claimed to be a cheaper mode of drainage than that of pumping, the mode now in use. I will now proceed to the consideration of that branch of the Sutro Tunnel question practically considered. These mines have been worked for about twelve years, more or less, extensively.

It is little more than ten years since I first took charge of a mine on the Comstock. For about three-quarters of that time I have been in charge of mines here, having been absent from this locality about two and a half years of the last ten; hence I speak on this question from experience.

The mine that I am now in charge of, and have been for more than three years past, (the Ophir,) has been, and is still, celebrated as being much the wettest mine on the Comstock, and yet we have no difficulty in overcoming all troubles of an aqueous nature, neither do we anticipate anything in the future of that character that will give us serious trouble.

After these general remarks I will proceed with a few estimates. Mr. Sutro (on page 17) gives us an estimate of what it will cost to pump in all the mines on the Comstock when a depth of 1,550 feet is attained. After very elaborate figuring, he gives us the astonishing sum of \$5,911,560 per annum. That depth is very nearly reached at this time in all the prominent mines, and a comparison can now very justly be made between the estimates made by Mr. Sutro and the actual cost, which, taking the Ophir as a guide, for the year ending May 31, 1871, will not exceed the sum of \$150,000 for all the mines, showing the estimate of Mr. Sutro to be very wild, and renders calculations based upon that estimate unreliable in the extreme.

What is the cheapest and most economical mode of freeing the mines on the Comstock from water—the present plan of pumping, or by means of the proposed Sutro Tunnel under the existing franchise? I state that the present cost of pumping will not exceed \$150,000 per annum.

Taking the estimate of Mr. Sutro as correct, that the daily yield of the mine is 1,500 tons, or 547,500 tons per annum, the two dollars per ton royalty give a sum per annum of \$1,095,000, the cost of drainage through the tunnel.

Comment on these two propositions I hold to be superfluous. There are two principal causes or reasons operating to reduce the cost of pumping on the Comstock in the future as compared with the past; and these are, first, the great reduction in the cost of fuel, (and that reduction is bound to continue until it reaches a price about half the present cost;) and, secondly, the positive decrease in the quantity of water as greater depth is attained; for I hold that there is no more certain event of the future than that the water will decrease in the Comstock as the mines grow deeper, the opinions of Mr. Sutro, Professor Richthofen, or any other scientific gentlemen, to the contrary notwithstanding, and the idea of running a tunnel four miles or more in length, at an outlay of millions of dollars, to tap what is almost certain to be very nearly a dry fissure, seems to me to partake of the absurd in the extreme. This is a dry country, and all who have looked upon it know it.

As a ventilator, this tunnel, if finished, would amount to just what a connection between any two or more mines would—no more and no less. Neither one could possibly be made to ventilate any exploring or prospecting work for which some mode of artificial ventilation, either by patent blower, air-pumps, or some other more efficient method, is necessary.

But the most important question of all in this connection presents itself, and, as yet, is unanswered—does ore in paying quantities exist in the Comstock at these great depths? Taking a practical and the most hopeful view of this question that the facts thus far developed will warrant, I am compelled to say there are grave doubts, notwithstanding Professor Riechthofen comes to the rescue and assures us that by his scientific and theoretical vision he sees it, and there is no doubt but ore in paying quantities exists in the Comstock fissure from the surface to untold depths. But gentlemen of his class have deceived us so often that, I am sorry to say, we miners have little faith in their scientific prognostications.

I will now proceed to consider the following questions propounded by the commission, so far as they apply to the workings of the Ophir mine:

1. Cost at various depths of sinking shafts, estimated by the cubic foot removed, or by the running foot for a shaft of given dimensions.

Actual cost of sinking main shaft from 270 feet to 1,002 feet=232 feet.

Time, 3 months—June, July, and August, 1871. Dimensions of shaft, outside of timbers, 18 feet 8 inches by 7 feet 4 inches.

	Total cost.	Cost per foot.
Labor:		
Miners..... \$10,092 00		
Carmen..... 959 00		
Blacksmiths and helpers..... 1,242 00		
Engineers and firemen..... 1,300 00		
Wood-hauling..... 185 00		
	\$13,778 00	\$48 85 ⁸ / ₁₀
Powder:		
647½ pounds giant powder \$760 81		
500 pounds Hercules powder 310 00		
Fuse and caps..... 51 00		
	1,121 81	3 97 ⁸ / ₁₀
Steel:		
757 pounds, at 20 cents.....	151 40	53 ⁶⁸ / ₁₀₀
Candles:		
1,300 pounds.....	244 65	86 ⁷⁵ / ₁₀₀
Wood:		
276½ cords, at \$10.....	2,765 00	9 80 ⁵ / ₁₀
Total amounts	18,060 86	64 04 ⁵ / ₁₀
Cost per cubic foot	46 ⁷⁹ / ₁₀₀	

2. The present cost of timbering the same, with the increase, if any, with the depth.

Actual cost of timbering main shaft.

47 sets timbers, 6 feet each =232 feet.

	Total cost.	Cost per foot.
Timbers in set:		
1,912 feet by 47 sets=89,864 feet, at \$22 per M.....	\$1,977 00	\$7 01
Labor:		
1 carpenter and 1 timberman, at \$5 each per day.....	920 00	3 26
Total amounts.....	2,897 00	10 27

Total cost of sinking and timbering main shaft 282 feet.

	Total cost.	Cost per foot.
Cost of sinking.....	\$18,060 86	\$64 04 ⁵ / ₁₀
Cost of timbering.....	2,897 00	10 27 ¹ / ₁₀
Total amounts.....	20,957 86	74 31 ⁶ / ₁₀

3. The cost of drifting in the various rocks met with in your operations, estimated either by the cubic foot, or by the running foot, specifying the dimensions of the cross-section.

Cost of running drift from 700-foot level, 866 feet.

Blasting ground. No timbers required. Size of drift, 4 feet 6 inches wide by 6 feet 6 inches high. Time, 8 months; February 15 to October 15, 1869. Six-hour watches—three men on each watch.

	Cost.	Per foot.
Labor:		
Miners.....	\$16,596 00	
Blacksmiths.....	1,452 00	
	\$18,048 00	\$20 84
Blasting material.....	3,099 72	3 57 ⁸ / ₁₀
Steel and tools.....	132 72	15 ³ / ₁₀
Candles.....	467 00	53 ⁹ / ₁₀
Total amounts.....	21,747 44	25 11
Cost per cubic foot.....	86 ⁵⁸ / ₁₀₀	

4. The cost of timbering the same.—No timbers used.

5. The daily progress made in the shafts and drifts through the various rocks, the largest force that can be worked to advantage being employed.

In main shaft, described in answer to question No. 1, six-hour watches are worked, with six men on each watch. Average daily progress, 3.06 feet.

In running drift described in answer to No. 3, six-hour watches, with three men per watch, were employed. Average daily progress, 3.578 feet.

6. The cost of raising ore, water, &c., from various depths.

Estimate of cost of raising ore from a depth of 1,750 feet, (level of the Sutro Tunnel,) with the machinery now in use. Size of cylinder of hoisting engine, 18 inches by 27 inches.

This estimate is based upon the following proposition: That two reel-shafts be coupled into one, running one cage up and one down at the same time; machinery being geared so that speed of the cage in the shaft is 800 feet per minute; double-deck cages being used, hoisting two cars at a time, each car containing 1,500 pounds of ore. Estimated to make six trips per hour, inclusive of all necessary stoppages or delays occasioned by lowering and hoisting men, and lowering timbers into the mine, and all necessary delays for repairs:

Engineers' wages, per day.....	\$10 25
Foremen's wages, per day.....	4 00
Wood-haulers' wages, per day.....	2 50
Three cords wood per day.....	30 00
Tar for ropes and oil for machinery, per day.....	2 00
Scaling boilers, per day.....	1 00
Wear and tear of machinery, per day.....	5 00
Interest on cost of machinery, \$28,000, at 1 per cent. per month.....	9 20
Total amount.....	63 95

Total cost per day for hoisting 216 tons of ore 1,750 feet, \$63 95, or, 29.6 cents per ton.

7. The cost of pumping at your mine for twelve months, preferably for the year ending June 30, 1871.

Actual cost of pumping 700 feet, for the year ending May 31, 1871.

Labor:		
Pitman's wages	\$2,007 50	
Engineers and firemen	5,309 50	
Wood hauler	703 00	
		\$8,020 00
Fuel:		
1,387 cords of wood, at \$12.....	16,644 00	
27½ tons of coal, at \$20.....	555 00	
		17,199 00
Oil and tallow:		
Lard and other oils.....	215 67	
1,315 pounds of tallow	162 37	
		378 04
Interest on cost of pumping-machinery, \$31,000, at 1 per cent. per month.....		3,720 00
Total cost		29,317 04
Value of water raised.....		8,975 00
Net cost of raising water		20,342 04

Amount of water raised during the year ending May 31, 1871.

Monthly average of daily measurements:

1870.		
June.	18 inches.	Present flow of water September 10, 1871, 5 inches.
July.	16 inches.	
August.	11 inches.	Decrease in amount of water at 700-foot level, from June, 1870, to date, 72.23 per cent.
September.	11 inches.	
October.	10 inches.	
November.	10 inches.	
December.	10 inches.	
1871.		
January.	9 inches.	
February.	9 inches.	
March.	9 inches.	
April.	8 inches.	
May.	7 inches.	

The above measurement is what is termed on this coast "Miner's measurement," the water running under a six-inch pressure.

13. At what depth will the present machinery be available for hoisting the ore or clearing the mine from water?—Hoisting machinery, 2,500 feet; pumping machinery, 1,500 feet.

16. What has been the expense of prospecting the mine for the year passed?—Total mine expense for the year ending August 31, 1871, \$140,571 87. All work being of a prospecting nature.

Should any of the foregoing answers require explanation, I shall be pleased to furnish the same at your request.

Very respectfully, your obedient servant,

H. H. DAY,

Superintendent Ophir Silver Mining Company.

H. G. WRIGHT,
*Brevet Major General and Senior
Officer Sutro Tunnel Commission.*

APPENDIX D.

GOULD & CURRY.

SUPERINTENDENT'S OFFICE, GOULD &
CURRY SILVER MINING COMPANY,
Virginia, Nevada, September 2, 1871.

GENERAL:—In accordance with your request, I herewith inclose answer to your interrogatories of 28th of July.

Yours, respectfully,

C. C. BATTERMAN,

Superintendent Gould & Curry Silver Mining Company.

H. G. WRIGHT,

Major General, Senior Officer Sutro Commission.

No. 1. The value of the bullion extracted from the Comstock lode?

Answer. The value of the bullion extracted from the Gould & Curry mine up to and including June 30, 1871, is \$15,555,232 24.

No. 2. The present and probable future production?

Answer. Present production nothing—the future, dependent upon the success of the explorations now in progress.

No. 3. The geological and practical value of said tunnel as an exploring work?

Answer. Geologically, it would, no doubt, be of value to the scientist. To the Tunnel Company it would be of great value as determining the existence or otherwise of ore deposits within the bounds of its land grant, and to the eastward of the explorations made by the mining companies at work upon the Comstock lode. To the Comstock it would be of no practical value. The advantages of ventilation supposed to accrue from the construction of the tunnel are more imaginary than practical. The current of air supposed to be created by the connection of the tunnel with the working drifts of the various mines will, no doubt, be confined to the main drifts and shafts, while the stopes—which are the working points in all mines—will have to be furnished with air then as now, by artificial means, which can be done by air-engines much more cheaply through the present shafts than through the proposed adit.

The economy claimed over the present method in bringing the ore to the surface is entirely imaginary; that I assert this advisedly, allow me to call your attention to the table in answer to supplemental question No. 6—to the accuracy of which I am willing to certify. The cost of “chuteing” the rock from any point in this mine, say 500 feet above the level of the proposed tunnel, would be greater than to raise the rock to the surface from that depth through the shaft where it would be in dump ready for transportation, while after delivery by “chute” to tunnel level there would still remain four miles of transportation to reach the surface at the mouth of the tunnel, where the ore would be at a greater distance from the reduction works than when in the dump at the top of the shaft.

In this connection, allow me to call your attention to the fact that there is a considerable quantity of low-grade ore remaining in this mine that cannot be worked now with profit, but which, at a lower cost for reduction and material, can be extracted with a moderate profit to the mine; but if to this is to be attached a royalty, I fear the day is still far distant when it shall be made available.

The average value of the ore extracted from this mine in 1868—and which was selected from the reserve just mentioned—was \$18 14 per ton, at a cost of \$16 35 per ton for extraction and reduction; if to this cost had attached the proposed royalty, the result would have been a loss to the company. Some of the other mines on the Comstock have a greater quantity of this class of ore than the Gould & Curry, and as an illustration of the meager margin of profit I beg leave to call your attention to the report of operations in the Savage mine for the year ending June 30, 1871, when the average profit for the year in ore extracted was 42 cents per ton, the gross yield being \$21 43 per ton.

The tunnel, if of any value at all to the Comstock, would be as a drain-tunnel, though even this proposition is a matter of doubt, the explorations on the lode all going to show a decrease of water with increase of depth attained.

From careful estimates, I am satisfied that in this mine 6,500 gallons of water per hour can be raised from a depth of 2,000 feet at a cost of \$84 per day; from this should be deducted the value of the water, which, at present rates, would be about \$1,000 per month, leaving the cost of pumping \$1,500 per month of thirty days; this on the amount of ore produced last year, 24,305 tons, would amount to 75 cents per ton; add to this the cost of raising rock from same depth, 71 cents per ton, and we have a total cost for rock and water of \$1 46 per ton, or 27 per cent. less than the proposed royalty.

If the yield of ore should be equal to the capacity of the machinery at a depth of 2,000 feet, 194 tons per day, the cost of pumping water and raising ore would be \$1 02 per ton, or 50 per cent. less than the proposed royalty, and only equaling the proposed toll of 25 cents per ton per mile.

Supplemental questions.

No. 1. Cost, at various depths, of sinking shafts, estimated by the cubic foot removed, or by the running foot, for a shaft of given dimensions.

Answer. Size of shaft, 13 feet 2 inches by 8 feet 10 inches.

Cost of labor for running foot	\$48 86
Cost of keeping tools in repair	1 97
Cost of powder, fuse, &c.	7 36
Total	<u>58 19</u>

The above is the actual cost of sinking 109 feet in this mine, commencing 1,191 feet from the surface and terminating at 1,300 feet. The rocks passed through were quartz and porphyry, the former predominating unusually hard, consequently the progress was very slow and the work exceptionally costly.

No. 2. The present cost of timbering same, with the increase, if any, with the depth.

Answer. Size of timber used, 12½ by 14 inches; lagging, 3-inch plank.

Cost of timber, &c., per foot in depth	\$8 84
Cost of labor framing	2 00
Total cost per foot in depth	<u>\$10 84</u>

The cost of labor in placing the timbers in position is included in the cost of labor for sinking. No material increase of cost with increase of depth.

No. 3. The cost of drifting in the various rocks met with in your operations, estimated either by the cubic foot or by the running foot, specifying the dimensions of the cross-section.

Answer. The following is the actual average cost per running foot of two drifts run in this mine during the year 1870. I have selected these two for the reason that they were of the greatest length, and the work was prosecuted uninterruptedly, affording a fair average as to progress and cost.

Eldorado Potosi drift, 101 feet below the surface, 480 feet in length, running obliquely across the stratification, 44 feet hard-blasting porphyry, 30 feet clay, 80 feet of quartz, 326 of porphyry, that was worked with pick. Size of drift outside of timbers, 8 feet high, 5 feet 9 inches wide at top, 6 feet 10 inches at bottom inside of timbers; 6 feet 3 inches, 3 feet 6 inches, and 4 feet 8 inches. The cost of placing timbers in position included in cost of running drift.

	Per foot.
Average cost of 44 feet	\$8 00
Average cost of 436 feet	5 00

Seventh-station drift, 1,167 feet below surface, 600 feet in length, running obliquely through heavy clay and hard porphyry. Size outside of timbers, 8 feet 10 inches in height, 3 feet 9 inches wide at top, 6 feet 9 inches in center, 5 feet 10 inches at bottom. Inside size, 6 feet 4 inches, 2 feet, 3 feet 10, and 3 feet 6 inches. Average cost per running foot, including placing of timbers, \$8 10. In this drift the clay, by swelling, was continually displacing the timbers, which had to be eased by cutting away behind them; in many instances we were compelled to use jack-screws to force them back to position, which makes the average cost of this drift more than it would otherwise have been.

No. 4. The cost of timbering the same.

Answer. The Potosi drift, timbered in square-tunnel sets, size of timber 8 by 10 inches, and 3 by 6 inch lagging; sets placed 5 feet apart; cost per running foot, including framing, \$1 89.

Seventh-station drift, size of timber used 14 by 14 inches, framed in arch plank lagging; sets placed 5 feet apart; cost per running foot, including framing, \$4 90. The cost per running foot, timbered in square sets, would have been \$4 76.

No. 5. The daily progress made in the shafts and drifts through the various rocks, the largest force that can be worked to advantage being employed.

Answer. In sinking shaft from seventh to eighth station, that is, from 1,167 to 1,300 feet, the excavation has been entirely within quartz and porphyry, the former predominating and exceedingly hard, as is evidenced by the quantity of powder used. The average progress was 18 inches in depth per twenty-four hours. Twenty men employed; four shifts of five men six hours each. In such rock as was generally found above the 1,167 level the same force would have made about 3 feet each twenty-four hours. In Potosi drift the formation being hard porphyry, soft porphyry, clay, and quartz of average hardness, the drift running obliquely across the formation, the average progress was, through the former, hard porphyry, 4 feet per day, twenty-four hours. Eight men employed; four shifts of two men six hours each. In seventh-station drift, 600

feet in length, formation heavy clay and hard porphyry drift crossing the strata obliquely; the average progress was 3 feet in twenty-four hours. Six men; three shifts of eight hours.

No. 6. The cost of raising ore, water, &c., from various depths.

Answer:

Depth from surface.	Capacity of machinery per 24 hours.	Cost of fuel per ton.	Cost of labor, repairs, and all other expenses.	Total cost per ton.
<i>Feet.</i>	<i>Tons.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
400	1,000	07.08	05.84	12.92
800	750	12.09	09.5	22.4
1,300	408	23.1	18.9	42.
1,400	367	25.41	19.87	45.28
1,500	330	27.95	20.84	48.79
1,600	297	30.74	21.81	52.55
1,700	267	33.81	22.78	56.59
1,800	240	37.19	23.75	60.94
1,900	215	40.90	24.72	65.62
2,000	194	44.99	25.69	70.68

The engines work independently, that is, each engine hoists and lowers separately. If the engines were geared together, so that when one cage was being hoisted the other was lowered, the cost per ton would be considerably reduced.

In the above table of cost is included wood, water, \$600 per month, oil, engineers, firemen, boiler-cleaner, woodman, and average cost of keeping machinery in repair.

The cost of raising the water in this mine from a depth of 825 feet, also running pump while sinking to 1,300-foot station has been \$60 per day, the quantity of water raised about 3,500 gallons per hour.

The capacity of the pumps is 6,500 gallons per hour. I estimate the cost of pumping from a depth of 2,000 feet, working pump to full capacity, at \$83 60 per day. This estimate includes wood, engineers, fireman, pitman, &c. From this estimate of cost should be deducted the value of the water.

No. 7. The cost of pumping at your mine for twelve months, preferably for the year ending June 30, 1871.

Answer:

Cost for the year	\$16,425 00
Deduct water sold	6,000 00
	<u>10,425 00</u>

No. 8. Has the water in your mine increased or diminished with the depth, and in what proportion?

Answer. The greatest quantity of water in this mine was found above the sixth level from the surface to a depth of 825 feet; from this point downward the quantity of water is very small.

At the eighth station 1,300 feet from the surface the lode is practically dry; were it not for the seepage from above, which finds its way down the shaft, working at this depth could be prosecuted without the aid of pumps.

I beg to call your attention to the fact that in this mine no considerable bodies of water have been encountered except when the country to the west of the lode has been penetrated.

No. 9. The cost per ton of ore for milling, and when the cost of the transportation to the mill is included the cost of the latter.

Answer. The ore from this mine has been delivered to the mills at the dump. The price paid for milling, which included transportation, was \$12 per ton.

No. 10. What is the present cost of the artificial ventilation of your mine, and how does it increase with the depth.

Answer. The cost of ventilation by Roof's blower, carrying the air down the shaft through wooden tubing and distributing it through the drifts by galvanized pipe, is \$9 35 per day, furnishing air to all the drifts from 625 feet below the surface to 1,300 feet. No increase of cost with increase depth, except the cost of continuing tubing down the shaft.

No. 11. How long a time, at the present progress of working, will it require to exhaust all the profitable ore in the mine above the 600-foot level?

Answer. There is no known body of ore existing above the 600-foot level that could be profitably worked at the present cost of reduction, &c.

No. 12. How long between the 600 and 1,000 foot level?

Answer. No paying ore has ever been found in this mine below 600 feet.

No. 13. At what depth will the present machinery be available for hoisting the ore, or clearing the mine from water?

Answer. Two thousand feet.

No. 14. See answers to Nos. 6 and 7.

No. 15. What is the width of the lode, and also of productive vein-matter, at the various levels of your mine?

Answer. The width of the lode is undetermined. The productive portion of the lode had an average width, from near the surface to a depth of 525 feet, from four of 40 feet; below this depth ore has not been found in paying quantity.

No. 16. What has been the expense of prospecting the mine for the year past?

Answer. For the year ending June 30, 1871, \$193,670 92.

No. 17. How does the pay-ore compare at each level, from the surface downward?

Answer. That taken from near the surface was the most valuable.

All the measurements of depth given in these answers are from top of shaft, except that to No. 15, which is from station A, King map. To make measurements correspond with those used in the Sutro map, 200 feet should be added, that being the difference in level between shaft and station A; thus, our eighth station, which I designated as 1,300 feet, would be 1,500 feet on Sutro survey.

C. C. BATTERMAN,

Superintendent Gould & Curry Silver-Mining Company.

VIRGINIA, NEVADA, September 2, 1871.

APPENDIX E.

SUPERINTENDENT'S OFFICE, SAVAGE MINING COMPANY,
Virginia City, Nevada, September 16, 1871.

DEAR SIR: The value of the bullion extracted from the Savage mine during the year ending June 30, 1871, was \$818,216 50. From the want of the necessary data I am unable, at the present time, to state the value of all the bullion extracted from the mines on the Comstock lode from the time they were first opened, or during the past year.

Not a small portion of last year's production in bullion came from the tailings which had accumulated at mills in former years, and from the remnants of ore bodies left from the old workings in the upper levels of the mine.

From a general view of the present condition and prospects of the mines on the Comstock lode taken together, I do not anticipate any material change for the next year or two from the last year in the amount of bullion which will be produced. Any increase must depend entirely upon developments which cannot now be foreseen.

The practical value of the Sutro Tunnel as an exploring work can only be a matter of conjecture. In the ground which it traverses it may or may not develop important veins of ore. In this respect it stands on even footing with the numerous similar enterprises on a smaller scale which have been carried on in California and in this State. In a geological point of view the discoveries on the route of the tunnel may give much interesting and valuable information. But I am unable to see what practical good any geological development made outside can be to mining within the limits of the Comstock lode. The attempts made by experts in former years to apply the rules and principles of geology in determining the extent, boundaries, and value of the vein were found entirely futile. With practical miners the pick and shovel have come to be recognized as the only reliable experts within the limits of the Comstock lode. In regard to the value of the Sutro Tunnel as an aid to deep mining on the Comstock lode, my own individual opinion has been formed from a few simple facts, and not from any desire to establish any particular theory which has to be supported by an army of figures and statistics. The chief purposes urged, as I understand, for carrying on this work are drainage, the cheaper extraction, and the cheaper reduction of ore. Until experience proved the contrary, it was a prevalent supposition, even among our leading mining men, that, by tapping the lead at one point, the whole vein would at once be drained down to the level of that point. This idea is exploded. The vein matter of the Comstock is intersected in various directions, longitudinally, crosswise, and diagonally, with clay seams impenetrable to water, and within the sections of a single mine thus bounded by clay seams or walls is confined more or less water, and a mine cannot be said to be drained until every one of these seams has been reached by drift and has been penetrated.

Suppose this tunnel, as proposed, should be completed up to the east edge of the lode at the Savage mine, connections between this tunnel at that point and the several mines for the purpose of drainage would render necessary the running of tunnels for that specific purpose at an immense cost to the mines. The Crown Point and Belcher, two of the most productive mines in Gold Hill, could only be reached by a tunnel nearly one mile long. In the opposite directions to the north it would require a tunnel about a half mile in length to reach the Ophir mine.

Down to a level with the Sutro Tunnel, I consider that our present mode of extracting ore through shafts directly over the mines, and by machinery, will be the most direct, expeditious, the cheapest, and that by some addition to the present power the machinery will be amply sufficient to drain and to extract ore down to the level of that tunnel, and even beyond that depth, and that all this will be accomplished before the Sutro Tunnel can, in any reasonable probability, be completed up to the Comstock lode.

If it be contemplated by the projectors of this tunnel, as one of the objects of this enterprise, to have the ore taken out through this tunnel and deposited near the river, to be reduced by water-power in mills to be erected, I would reply, in answer to that view of the case, that a large proportion of ore is now being transported to mills already in operation on the river, over a convenient and substantial surface-railway, instead of being drawn four miles under ground by man or horse power. As to the necessity or advantage of such a tunnel to aid in the working of the mines below its (the tunnel's) own level, so little is known of the extent of the lode downward, and there are so many uncertainties connected with it that it seems like making a costly provision for objects which may not eventually require its construction, even if the present means of hoisting and pumping were not sufficient to work below that level. The above views, formed from long and mature consideration, are respectfully submitted by

Your obedient servant,

T. B. SHAMP,

Superintendent Savage Mining Company.

Major General H. G. WRIGHT,

Senior Officer of Sutro Tunnel Commission.

OFFICE SUTRO TUNNEL COMMISSION,
Virginia City, Nevada, July 28, 1871.

SIR: By the act of Congress approved April 4, 1871, this commission is required to report, among others, upon the following points, viz:

1. The value of the bullion extracted from the mines on the Comstock lode.
2. Their present and probable future production.
3. The geological and practical value of said tunnel as an exploring work.

Much of the information required by the above can be obtained only from the companies engaged in mining on the Comstock lode, and as regards the rest, the information which the companies can afford will be of the highest value to the commission in the discharge of its duties. I am, therefore, instructed to request of you your views, in writing, upon the points above quoted, as well as upon any others which you may deem to have a bearing upon the question of the construction of the Sutro Tunnel.

I also take the liberty, under the instructions of the commission, to append a series of questions having a bearing upon the portions of our duties not enumerated above, your answers to which will be important in making up our estimates of the probable cost of the proposed tunnel, and its value as an aid to deep mining on the Comstock lode.

Should your reply to the foregoing not be ready before the commission leaves Virginia City, please forward it addressed to me at the Army Building, New York City.

The earliest practicable answer will, however, oblige,

Very respectfully, your obedient servant,

H. G. WRIGHT,

Brevet Major General, Senior Officer of Commission.

Colonel T. B. SCHAMP,

Superintendent Savage Mine.

The following are the questions to which answers are asked:

1. Cost, at various depths, of sinking shaft, estimated by the cubic foot removed, or by the running foot, for a shaft of given dimensions.
2. The present cost of timbering the same, with the increase, if any, with the depth.
3. The cost of drifting in the various rocks met with in your operations, estimated either by the cubic foot or by the running foot, specifying the dimensions of the cross section.
4. The cost of timbering the same.
5. The daily progress made in the shafts and drifts through the various rocks, the largest force that can be worked to advantage being employed.

6. The cost of raising ore, water, &c., from various depths.
7. The cost of pumping at your mine for twelve months, preferably for the year ending June 30th, 1871.
8. Has the water in your mine increased or diminished with the depth, and in what proportion?
9. The cost per ton of ore for milling, and where the cost of transportation to the mill is included, the cost of the latter.
10. What is the present cost of the artificial ventilation of your mine, and how does it increase with the depth?
11. How long a time, at the present progress of working, will it require to exhaust all the profitable ore in the mine above the 600-foot level?
12. How long, between the 600 and 1,000 foot levels?
13. At what depth will the present machinery be available for hoisting the ore or clearing the mine from water?
14. What additional expense will be incurred, if any, per 1,000 feet of additional depth for the purpose above named, calculating from the 1,000 foot level?
15. What is the width of the lode, and also of productive vein-matter at the various levels of your mine?
16. What has been the expense of prospecting the mine for the year passed?
17. How does the pay-ore compare at each level, from the surface downward?
- Answer to question 1. Dimensions of shaft are 28 feet by 8 feet; average cost of sinking, 42 per running foot.
- Answer to question 2. Present cost of timbering shaft, at the depth of 1,300 feet, 14 per running foot. No material increase in this cost for the next few hundred feet.
- Answer to question 3. Cost of drifting in the various rocks from \$6 to \$24 per running foot; average cost on the 1,300-foot level, \$10 per running foot. Dimensions of cross-sections of drifts, 7 feet high, $6\frac{1}{2}$ feet wide at the bottom, and $4\frac{1}{2}$ feet wide at the top.
- Answer to question 4. Cost of timbering drifts, \$1 58 per running foot.
- Answer to question 5. Progress in sinking shaft averages 1 running foot per day; progress in running drifts, from 1 to 5 feet running per day, according to the character of the rock.
- Answer to question 6. Cost of raising ore from the 1,300-foot (or lowest) level, \$1 per ton.
- Answer to question 7. Cost of pumping of the year ending June 30, 1871, \$22,337. The present flow of water is 19,116 gallons in twenty-four hours.
- Answer to question 8. The flow of water on the 1,300-foot (or lowest) level is somewhat less than it was on some of the levels above. The proportion in which it has diminished cannot now be accurately ascertained.
- Answer to question 9. The average cost of milling ore for the last year has been \$9 95 per ton, average. This includes transportation, which costs from 75 cents to \$3 per ton, according to the distance.
- Answer to question 10. The present cost of artificial ventilation of the mine is about \$12 per day.
- Answer to question 11. Six month's time, at the present rate of working, will exhaust all the profitable ore in sight above the 600-foot level.
- Answer to question 12. Six month's time will also exhaust all profitable ore in sight between the 600-foot and the 1,000-foot level.
- Answer to question 13. The depth of the present lowest level is 1,300 feet. The present machinery will be available for hoisting ore from a depth 400 feet below this level, and for pumping the mine 1,500 feet deeper.
- Answer to question 14. The chief additional expense of hoisting ore, and pumping from a depth 1,000 feet below the 1,000-foot level will be the extra steam power required, and that is estimated to be but a small fractional proportion of the power required in hoisting and pumping from the 1,000-foot level.
- Answer to question 15. The width of the productive vein-matter on the several levels which have been worked has varied from 4 feet to 40 feet.
- Answer to question 16. The expense of prospecting the mine for the year ending June 30, 1871, was \$116,371.
- Answer to question 17. The value of the ore per ton has diminished from the upper levels downward.

T. B. SHAMP,

Superintendent Savage Mining Company.

VIRGINIA CITY, NEVADA, September 16, 1871.

APPENDIX F.

OFFICE HALE & NORCROSS'S SILVER-MINING COMPANY,

Virginia, October 3, 1871.

DEAR SIR: In reply to your printed circular, received last month, I will state to

questions Nos. 1 and 2: The size of our main shaft is 6 feet wide and 18 feet long, divided into three compartments. The cost of sinking this shaft has been \$23 25 per foot, and of timbering the same \$16 50 per foot, and, from the limited quantity of material possible to be excavated from a piece of ground of those dimensions, (necessarily employing the hoisting power only a small part of the time, and not continuously,) the increase in cost of sinking the shaft has not been perceptible, particularly as water does not impede this work to so great an extent as when advancing downward near the surface.

Question No. 3. The average dimensions of our drifts and tunnels are $5\frac{1}{2}$ feet wide and $7\frac{1}{2}$ feet high. The average cost of running these drifts is \$8 per foot.

Question No. 4. The cost of timbering these drifts is \$2 per running foot.

Question No. 5. From 3 to 12 feet per day is the distance run in these drifts, according to hours worked and character of the material penetrated.

Question No. 6. The cost of hoisting ore from present station is 50 cents per ton, and has not greatly varied therefrom when extracted from the upper levels.

Question No. 7. For the year ending June 30, 1871, the cost of pumping water has been \$2,320.

Question No. 8. The water to be pumped is less than when working near the surface; it is about one-sixth of the former volume.

Question No. 9. This company has paid from \$9 to \$12 per ton for milling its ores. (The mills pay their own transportation, which has been from 65 cents to \$1 10 per ton.)

Question No. 10. As yet no increase in cost of ventilating the mine is noticed; the expense has averaged us \$4 per day.

Question No. 11. About five years.

Question No. 12. About three years.

Question No. 13. To a depth of 2,500 feet this company has nearly completed the placing of ponderous machinery to aid in the prospecting of the mine at greater depths. We have no ropes of that length yet, but will have them made long before required. Our reels are adapted to such lengths, being flat-steel wire-ropes.

Question No. 14. To a depth of 500 feet below our present lowest level (called the 1,300-foot level) no particular augmentation of expense will be necessary. For a greater depth I cannot at present state.

Question No. 15. The width of our pay-vein was, at 100 feet in depth, 90 feet; 200 feet in depth, 80 feet; 300 feet in depth, 50 feet; 1,200 feet in depth, 45 feet; 1,300 feet in depth, 80 feet.

Question No. 16. Our prospecting expenses for the year have been \$147,000.

Question No. 17. The pay-ore lessens in value as we descend. It then increases in value, and again lessens to a still greater extent.

Very respectfully, yours,

J. G. FAIR, *Superintendent.*

Mr. H. G. WRIGHT,
Army Building, New York.

APPENDIX G.

OFFICE CHOLLAR POTOSI MINING COMPANY,
Virginia City, Nevada, September —, 1871.

RESPECTED SIR: In compliance with your request made at this place I herewith submit the following as answers to the various questions contained in your circular bearing date at Virginia City, Nevada, July 28, 1871:

CONGRESSIONAL QUESTIONS.

Question No. 1. Value of bullion extracted from mines on the Comstock lode.

Answer. Total amount of bullion extracted from this mine is \$11,772,105 47.

Question No. 2. Their present and probable future production.

Answer. For the twelve months ending May 31, A. D. 1871, the average monthly yield of bullion was \$288,285 25. For the months of June and July following the bullion production averaged \$166,312. The future yield of bullion necessarily depends on the success of prospecting. At this writing indications are positively and decidedly against the hope that any twelve months in the future will nearly equal the production of the past year.

Question No. 3. The geological and practical value of said tunnel as an exploring work.

Answer. *Geologically*, science may derive information of value to students in that branch of learning, although the probabilities strongly favor the opinion that the same geological knowledge can be acquired more easily and at vastly less expense. *Practically* considered, after many years experience in mining—five of which have been exclusively devoted to the Comstock lode, in directing and super-

intending mining operations—being thus employed, opportunities were abundant to gain a knowledge of the formations and to study the nature of the various deposits that make up this lode. Also, to satisfactorily determine water-sources that have supplied the subterranean reservoirs met with in explorations along this river.

The result of this experience dictates the follow conclusions: That the proposed adit known as the Sutro Tunnel is not now, and never will be, a necessity to the lode, either for prospecting purposes, ventilation, or for the economical handling of metal-bearing material, waste or débris or as a means of entry or exit for men to the various mines located on the Comstock. The reasons why said adit is not needed for prospecting purposes: This company have a shaft and incline sunk immediately on the lode to the vertical depth, from the top of the shaft, of 1,250 or 1418 feet from point [A] as designated on Clarence King's atlas of Mining Industry. The shaft is located near the center of this company's claim; that is, so far as a north and south line is considered. For a better understanding of the location of the shaft, and the explorations carried on from the same, reference is hereby made to the atlas mentioned above. From this shaft explorations have been, and always can be, carried on with far greater economy, more safety, and in a more satisfactory manner than could be done through the proposed adit, owing to the fact that the shaft, being on and passing through the lode, we have our entire operations, as it were, in a "nut-shell." Stations are made at each hundred feet in depth; from these, drifts are driven running north and south, east and west, or at any other point of the compass desired. From these drifts, as they are pushed on, we can and do gather daily information of the value of material passed through; the condition and prospect of the lode for the next level. Through this shaft we pass our men to the various sections of the mine allotted to them. Down here goes all the timber used in all portions of slopes, drifts, and winges, also the tools; in short, everything needed for the perfect working of the mine. By aid of machinery at the surface all of this work is done. Allow me to ask how would it be to run in timber four miles through a tunnel, and hoist the same up seventeen hundred feet vertically, as we would be compelled to do—this company having done no work for two years last past below the 200-foot level of their shaft—and from there distribute them through the mine. Presuming we were down on the 1,000-foot level extracting ore, and this tunnel, as is proposed, the means of entry and exit for ore, men, and timber, we would then be compelled to hoist our timber 800 feet by hand—as the projector of the tunnel assumes that no machinery is required to operate the mines after the tunnel is complete—and the poor toiling miner must climb up by sheer muscle-power the same distance. Imagine, if you can, hundreds, ay, thousands of men climbing up and down these vertical ladders distances varying from five to seventeen hundred feet, and then compare it with the ease and safety that they are placed at the various stations in the shaft by the aid of machinery we now have in use at our mine; and does it not comport with good economy to spend the muscle-power at the face of drifts, or in the slopes, rather than exhaust the energies of your men climbing up and down immense vertical heights on ladders? Hence I assert, without fear of successful contradiction, that for the purpose of exploring this lode the proposed tunnel would prove a positive failure.

Concerning the country east of the Comstock, and through which this proposed adit is supposed to pass, I claim no knowledge. All reasoning on what exists at great depths east must necessarily be theoretical. My conclusions are that, at the depth this proposed tunnel would come, no precious metal exists outside of the main vein. Some prominent croppings eastward have been operated on most of the time during the past eleven years. The few hundred feet in depth that have been attained on them resulted in practically exhausting the extremely limited amount of precious metals, and in nearly every instance has been the financial ruin of those interested.

To illustrate the supposed benefits to be derived from this proposed tunnel for ventilation, we will assume that the same is completed along the whole line, and connected with each shaft—a bold assumption, I grant—the currents of air supposed to be passing rapidly through the tunnel and shafts, with all this imaginary air passing through these tunnels, not a particle can be had at the slope we are working 700 feet west, as is the case in this claim, of the shaft. To get air in a slope or drift away from the shaft machinery must be used. All practical miners are aware of this fact, consequently the applying of compressed-air machinery for ventilating these mines, and using the engine in deep levels to hoist with is being considered, and will, no doubt, if the prospects of the lode justify, be soon put in operation. With this machinery, and a connection of the various shafts, a more perfect system of ventilation will be secured than any other method can afford, and at an expense that would be considered as nothing when compared with the expense attending the very imperfect manner of ventilation as proposed by the owners of the "adit franchise."

Handling of ore.—Please, sir, come with me and examine the matter of passing the ore that this company is now mining, or ever has mined, through this proposed tunnel. We start at the mouth of this company's shaft, and go down 178 feet; here is the station. We leave the shaft, and go in west 16° south for 700 feet; here we are under where the large body of ore known as the Belvedere existed. North of us to the

company's north line, and down below us 280 feet, making 458 feet in depth from mouth to shaft, is the section of country from which all the ore has been taken that produced the nearly \$12,000,000 in bullion mentioned in the beginning as the gross product of the mine. Below this 458-foot level, we have gone 800 feet without finding ore, and as we attained depth the more discouraging our prospects became. That is why two years have passed without our making an effort to sink further. Had even the slightest encouragement been developed, we should have continued the sinking, and would have been at this date 300 feet below the level of the proposed tunnel.

Pardon this digression. Let us return to the point 700 feet west of the shaft, and consider the proposition of running this ore from here to the shaft, and dumping the same down a chute 2,000 feet in length. Why so long? Because the chute must be on an angle of 45° to conform to the west wall, and to reach the tunnel from this level at the shaft. Can a chute be made to work that distance and on that angle? We practical miners would promptly say, no, sir; as we find it very difficult to maintain chutes 300 or 400 feet in length standing vertical. Do we ever make them on angle? Never at 45°, and never on any angle if we can avoid it, as they clog and wear much more quickly than vertical ones. Sir, permit me to ask, would you not consider us guilty of the most consummate folly to chute this ore down 2,000 feet (if it could be done) to this proposed tunnel, and run it out four miles for the privilege of hauling up heavy hills to mills, when we can run the car loaded with ore on the cage, hoist to the surface, 178 feet, place the ore in dumps made purposely to facilitate the loading of railroad cars or teams, and from this point the hauling is all the way down hill? What does it cost for hoisting from this level? During the month of July we hoisted 3,000 tons from here, drove the engine to run the blower for ventilating the drifts. To make steam necessary for this work ten cords of wood were consumed, or one-third of a cord each twenty-four hours. As you will notice, one car goes up, while the car in the next compartment of the shaft comes down. This arrangement makes hoisting easy, also very economical, and can be made to work equally well at 2,000 feet in depth as it does here at 200 feet. Fact is, the matter of hoisting from any depth up to 3,000 feet can be easily accomplished. How to get the ore out from these deep levels is not the important question on the Comstock. To find the ore to hoist, that is where the insurmountable difficulty comes in. To solve that problem requires more brain, muscle, and money than all other operations along the vein put together. Show us the ore, even at the depth of 3,000 feet, and I will give you a pledge, sir, that we will never ask how shall we get this ore out. Relative to this proposed adit as a means of entry and exit for men, the remarks already made are perhaps quite sufficient on that point. In brief, the whole tunnel project is simply impracticable, unnecessary, and totally uncalled for except as a drain. Here a few words will be applicable concerning the water-source and subterranean reservoirs that have been met with. All water found in this mine has been in reservoirs; these were formed by the clays uniting, so that in shape they represented huge basins. The water-supplies came from the surface. Melting of snows for thousands of years formed the water which circulated to and filled these reservoirs. Prospecting drifts pierced the clays and tapped these water deposits, and drained them, at the various stations, until the clays reached the west wall, which terminated the reservoirs. Below the 1,000-foot level in this mine water was not met with. On the 1,250-foot level there was no natural moisture. The Bullion claims, first adjoining us on the south, reached in depth 100 feet below our 1,250-foot station. At that point the earth was so intensely dry that dust caused from the working pervaded the drift, very much to the discomfort of the miners in said drift. If, in review, these facts are given their proper weight, the conclusions naturally follow that the construction of an immense adit to drain the Chollar Potosi mine would be superfluous.

To the best of our knowledge we have made answer to the congressional questions. We must next proceed to answer those interrogatories propounded by your honorable body.

COMMISSION QUESTIONS.

Question No. 1. Cost, at various depths, of sinking shafts estimated by the cubic foot removed, or by the running foot, for a shaft of given dimensions?

To give answer to this I will take the main incline, which commences at a point 891 feet down from mouth of shaft, and continues down on an angle of 45° to the east, a distance of 612 feet, at which point is our deepest level. Size of excavation is 14 feet in width, 9 feet in height. This excavation, as timbered, forms two compartments. The one on the pump side is 6 feet in height, in clear of timbers, by 6 feet in width, in clear of timbers. The other, the hoisting compartment, is 6 feet in height by 4 feet in width.

Excavation cost per running or lineal foot.....	\$20 00
Timber, 200 feet, at 2½ cents per lineal foot.....	5 00
Timber framing and setting, per lineal foot.....	5 00
Wear and tear of machinery, oils, and incidentals.....	5 00

Total cost per running or lineal foot..... 35 00

These figures represent the average cost per lineal foot for running said incline from the beginning to the completion, or the entire length of 612 feet. Had we taken down other two compartments to correspond with the main or vertical shaft, the expense would not have been so great proportionally. Material passed through was syenite.

Question No. 2. The present cost of timbering the same with the increase, if any, with the depth.

Answer to this question was merged in the answer made to No. 1, except "the increased cost of timbering as depth is attained." Practically speaking there is no increase in the cost.

Question No. 3. The cost of drifting, in the various rocks met with in your operations, estimated either by the cubic foot or by the running foot, specifying the dimensions of the cross-section."

Answer. In answering this question I will take as an example our drift at the 178-foot station, the same that you passed through when you visited the mine. The drift is 700 feet in length from shaft to Belvidere country. In making the drift all the material common to this section outside of the lode was passed through, such as andesite, quartzite, porphyry, and clay. The following figures show the cost per running or lineal foot:

	Per foot.
Running drift by contract, contractors furnishing candles	\$3 75
Timber and framing.....	1 85
Sharpening tools	1 00
Hoist and deposit earth.....	3 00
Total cost per foot.....	9 60

Size of drift outside of timbers is 6 feet 6 inches by 9 feet 5 inches by 5 feet 6 inches, (6 feet 6 by 9 feet 5 by 5 feet 6.) A diagram of shape and size of timber in drift was handed you. With your consent I make reference to said diagram to show size of drift in clear of timber.

Question No. 4. The cost of timbering the same.

Answer. As noted above, the timber and framing cost \$1 85 per lineal foot. The putting of them in place was included in the contract for running.

Question No. 5. The daily progress made in the shafts and drifts through the various rocks, the largest force that can be worked to advantage being employed.

Answer. In drift from shaft at 178-foot station the average progress was 6 feet 6 inches—6½ feet each twenty-four hours. In sinking the incline, average progress was 4 feet 8 inches each twenty-four hours. At both the incline and drift all was done that could be to hasten progress.

Question No. 6. The cost of raising ore, water, &c., from various depths.

Answer. At the 1,250-foot station material was taken up the incline, placed on the cages in shaft, and taken to the surface for an actual cost of 38 cents per ton. Had we succeeded in finding ore there in sufficient quantities to have kept the machinery steadily employed, 35 cents per ton would cover the cost of hoisting. The water quantity was so limited when we were operating in low levels that for weeks together the pumps would run one hour only out of the twenty-four. No record was kept of that expense.

Question No. 7. The cost of pumping at your mine for twelve months, preferably for the year ending June 30, 1871.

Answer. For two years last past this mine has been entirely exempted from pumping.

Question No. 8. Has the water in your mine increased or diminished with the depth, and in what proportion?

Answer. As depth was attained water diminished; at the lowest level there was no water.

Question No. 9. The cost per ton of ore for milling, and, where the cost of transportation to the mills is included, the cost of the latter.

Answer. For the year ending May 31, 1871, this company paid \$12 per ton for the milling and transportation of their ore. What the cost of transportation was I know not.

Question No. 10. What is the present cost of artificial ventilation of your mine, and how does it increase with the depth?

Answer. The points ventilated in this mine artificially at this time are three; expense attending same is 75 cents per day. The cost of ventilation at the deepest levels was \$6 per day.

Question No. 11. How long a time, at the present progress of working, will it require to exhaust all the profitable ore in the mine above the 600-foot level?

Answer. At present rate of working, three years' time will exhaust all the ore in the mine; that is, all the ore that is known to exist.

Question No. 12. How long between the 600 and 1,000-foot levels?

Answer. Up to this date no ore worthy of mention has been found below the 600-foot level.

Question No. 13. At what depth will present machinery be available for hoisting the ore or clearing the mine from water?

Answer. Two thousand and two hundred feet vertically; that is, the machine we had in use when the work at lower levels was being prosecuted would have been sufficient to have reached the distance above stated.

To question No. 14 answer will be omitted, for the reason that, all work at our lower levels being suspended, to attempt to make answer could be nothing more than guessing.

Question No. 15. What is the width of the lode, and also of productive view matter, at the various levels in your mines?

Answer. The width of the Comstock is a matter that is to-day entirely undecided. The productive view matter in this mine has averaged about 45 feet in width.

Question No. 16. What has been the expense of prospecting the mine for the year past?

Answer. For the year ending last 31st of May, \$143,800 were expended in repairs, prospecting, dead work, and incidentals. About \$100,000 of that amount was spent strictly for prospecting.

Question No. 17. How does the pay-ore compare at each level, from the surface downward?

Answer. The best ore produced by this mine, both as to quantity and quality, was taken out from the surface downward to the 300-foot level. Below that point the ore diminished in quantity and quality until it ran out.

Having concluded and made answers to the best of my understanding of your questions, I beg leave to say that should some of the answers prove to you vague, I will be most happy to make further explanation, if you will at any time, by letter or otherwise, signify your desire for such. Permit me to add further, that by referring to Clarence King's Mining Industry, or the Annual Report of this company, you may gather the information to make clear what may prove cloudy to you in some answers I have made.

I am, sir, very respectfully, yours,

ISAAC L. REQUA,

Superintendent of Chollar Potosi Mine.

Brevet Major General H. G. WRIGHT,
Senior officer of Sutro Tunnel Commission.

EXPLANATION.

On folio 20 the cost of hoisting from the 1,250-foot level is 35 cents per ton. This work was done thirty months ago. At that time wood was \$14 per cord; now the price is \$10. Other expenses were larger then than now.

Beyond a doubt further reductions in cost of fuel will be made; also other expenses which will so far economize operations that 25 cents would cover the actual expense of hoisting per ton from the 1,250-foot level.

I beg your indulgence to express to your honorable committee my firm conviction concerning the utility of the proposed tunnel. If said tunnel, with the proposed lateral branches, was now complete, and the owners of the tunnel should sign a compact with the mine-owner agreeing to relinquish their right to collect royalty, also that the mine-owners should have the right of way through said adit to run ore-timber, &c., and that tolls for use of said tunnel should not be collected, I am sure true economy would then be to hoist the ore by machinery to the surface as we are now doing.

Not wishing to exhaust your patience by dry figures to prove the above conclusions, I will simply say that proof abundant can be given to substantiate the assertion.

Respectfully, yours,

ISAAC L. REQUA.

OFFICE CHOLLAR POTOSI MINING-COMPANY,
Virginia, Nevada, July 21, 1871.

Gentlemen of the Sutro Tunnel Commission:

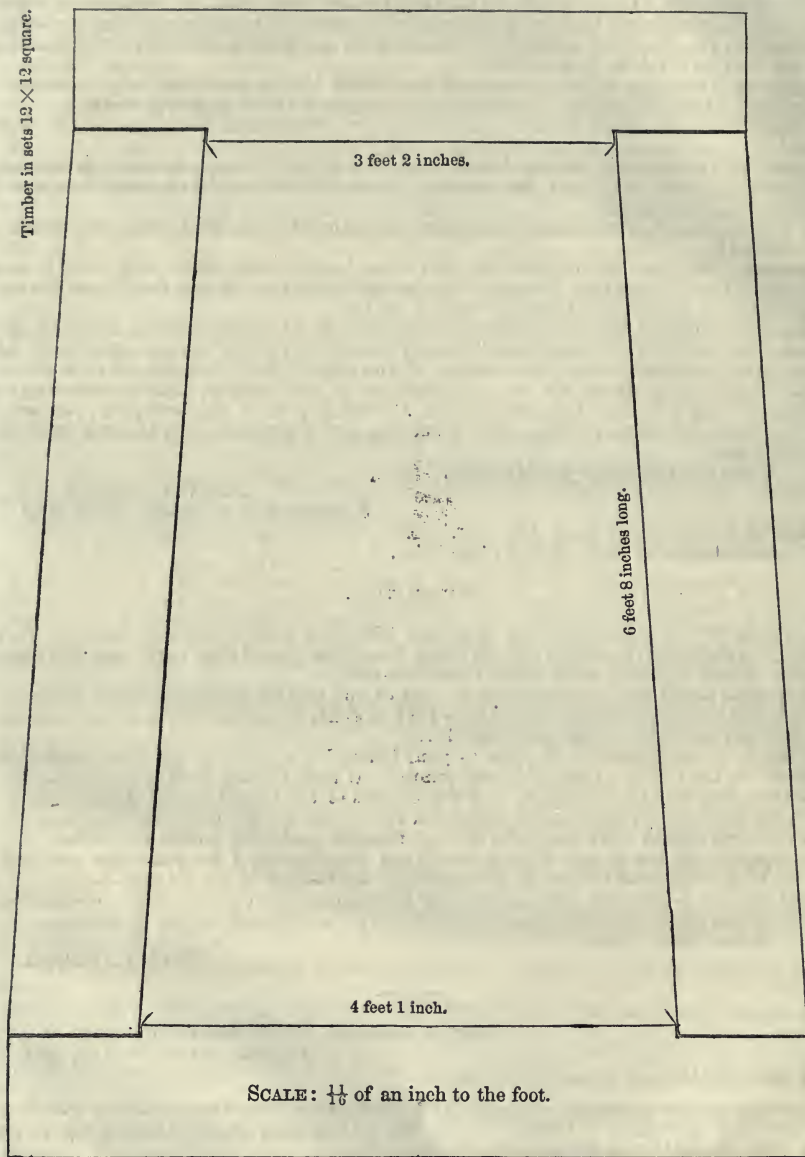
In reply to your questions concerning the cost of running the tunnel on the first station from new shaft of Chollar Potosi Mining Company west 700 feet, I beg leave to submit the following as the total cost per foot:

	Per linear foot.
Running drift by contract, contractors provide candles.....	\$3 75
Timber and framing.....	1 85
Sharpening tools.....	1 00
Hoist and deposit earth.....	3 00
Total.....	9 60

Size of drift outside of timbers is 6 feet 6 inches by 9 feet 5 inches by 5 feet 6 inches. The diagram connected gives the size in clear of timber.

Respectfully, yours,

ISAAC L. REQUA.
Superintendent.



APPENDIX H.

GOLD HILL, NEVADA, *October 4, 1871.*

DEAR SIR: The following are my answers to your various questions, which I have endeavored to answer as correctly as possible:

The Imperial and Empire shaft, $7\frac{1}{2}$ by 20 feet outside of timbers, containing 150 cubic feet to each running foot, was sunk between the 1,200 and 1,300-foot levels for 36 cents per foot, all in very hard blasting rock, or 24 cents per cubic foot, including labor of timbering. This portion of the shaft was sunk in the vein where the quartz was very hard, and a large quantity of water to contend with. In good ground the same shaft can be sunk for 15 cents per cubic foot, including labor of timbering, or \$18 90 per running foot.

No. 2. The cost to timber a shaft $7\frac{1}{2}$ by 20 outside of timbers, for 100 running feet, will require 15,000 feet of 12 by 12 and 10 by 15, and 11,200 feet of plank, equal to $2\frac{1}{2}$ feet of timber for each cubic foot of earth removed. Heavy ground will, of course, require more timber.

No. 3. The cost of drifting varies under so many different circumstances it is next to impossible to give a correct estimate. The size of our drifts, usually 6 by 9 outside of timber, with good cool air, can be run for \$7 per foot in hard blasting ground. The same ground with thermometer 110° will cost \$32 per running foot, or 59 cents per cubic foot.

No. 4. Cost of timbering the above drifts with sets 5 feet from centers would be \$3 24 per running foot, or 6 cents per cubic foot.

No. 5. Daily progress in good air, 7 feet; thermometer 110° , 18 inches to 2 feet.

No. 6. The cost of raising ore, &c., from 1,300-foot level to the surface is 27 cents per ton; that is, running our present machinery full capacity. Estimated cost from 2,000-foot level, 50 cents per ton. This estimate includes every expense except wear and tear of machinery.

No. 7. The cost of raising the water for the past year is difficult to get at. Not having any pumps it was raised to the service with a tank which we run only when absolutely necessary.

No. 8. See no perceptible change in water from 250-foot level to 1,300-foot level; if any, it has decreased.

No. 9. Company mill; cost of milling, \$7 90, including hauling, which was 45 cents per ton.

No. 10. Cost of artificial ventilation: one Root's blower, \$18 per day, carrying air to 1,340-foot level.

No. 11. All the available ore from the 600-foot level to the surface is exhausted, unless the cost of milling be reduced.

No. 12. From 600-foot level to our present lowest or 1,300-foot level, the vein in Imperial and Empire mines has been comparatively barren.

No. 13. Our present machinery in use at the mine will be available for hoisting to a depth of at least 2,500 feet.

No. 14. The width of the lode at the various levels varies; on 700-foot level the vein was 425 feet between walls; on 900-foot level, 308; on 1,300-foot level, 150 feet from east to west wall; productive vein-matter varies in width.

No. 15. The cost of prospecting for the year past was about \$110,000.

No. 16. The pay-ore was quite uniform from the surface down to 700-foot level, where the vein had got to be so very wide and ore so scattered it could not be made to pay. The vein seems to be getting more concentrated as we go deeper.

Very respectfully, yours, &c.,

R. N. GRAVES,

Superintendent Imperial and Empire Mines.

Brevet Major General H. G. WRIGHT,

Sutro Tunnel Commissioner.

APPENDIX I.

GOLD HILL, *August 31, 1871.*

DEAR SIR: Your favor of 28th ultimo duly received, and all your questions noted and answered as follows, as concisely as possible with regard to accuracy:

The value of bullion extracted from the Yellow Jacket mine since date of incorporation in February, 1863, as per books of company, was..... \$12,772, 172
Bullion from ore sold since the above date, and product of mine previous to the same, estimated at..... 1,500,000

Total amount of bullion..... 14,272, 172

The present yield of the mine is about \$180,000 per month, or about \$2,000,000 per year. The probable future yield will no doubt equal the past.

The geological value of the tunnel will consist in its showing a section of the country twenty-two hundred (thousand?) (22,000) feet east of the Comstock lode, a longer section than is probably shown by any similar work in the United States, and consequently of value to science. The practical value of said tunnel will be its use as an adit for the lode; as a means of ventilation it will be of value to any mine connecting its workings with the tunnel, but I think of no more value than the connections for air passages between the several shafts, as at present made. For the purposes of extracting ore above the tunnel level, it will be of very little value. We find that chutes over 150 feet in length are very expensive to keep in repair and open. Chutes of even that length are apt to become choked, when there is great danger and difficulty in clearing them, for which reason we seldom make our working levels more than 100 feet apart, (vertical,) or about 140 feet on slope of lode. Another objection is the additional labor of climbing and unpraising of tools and timbers.

The cost of sinking shafts varies under so many different circumstances that I can only give practical results that I can obtain from present and former work. A shaft 7 by 18 feet outside of timbers, or full size, can be sunk for \$17 64 per running foot, or 14 cents per cubic foot of earth removed. This is in blasting ground, and includes labor of timbering.

Yellow Jacket shaft, between 1,000 and 1,100-foot levels, 8 by 24 feet, full size, was sunk for \$27 per running foot, or about 14 cents per cubic foot, all blasting ground. Temperature of air 93°, labor of timbering included.

Incline below 1,100-foot level, full size, 9 by 14 feet, an angle of 45°, all blasting ground, sunk for \$20 per running foot, or 15½ cents per cubic foot. Average 3½ feet per day; four shifts of six hours each, four men each.

The cost of timbering such ground as the above, that is, cost of timber and framing the same, will be about 3 feet of timber (lumber or board measure) for each cubic foot of earth removed, or say 10 cents per cubic foot of shaft. Heavy clay or swelling ground will require twice the same.

The cost of drifting, like cost of sinking shafts, depends on character of ground and temperature of air. Have run drifts in hard blasting ground, (cool air, size full,) 6 by 9, for \$7 per running foot, or 13 cents per cubic foot of earth removed. Same ground, with temperature of air 107°, cost \$30 per running foot, or 55½ cents per cubic foot, cost of labor of timbering included in the above. With cool air made 3½ feet per day; with air at 107°, 20 feet per month.

Cost of timber for drift above size (6 by 9 feet) will be \$3 42 per running foot, or 6½ cents per cubic foot. Have run drifts the above dimensions, good working ground, and timber the same, 10 feet per twenty-four hours.

The cost of raising ore, waste, &c., the past ten days, from 1,130-foot level to the surface, (3,025 tons,) was 37½ cents per ton of 2,000 pounds. Estimate that we can raise ore, &c., from 2,000-foot level for 64 cents per ton. The above includes all cost of engineers, brakeman, firemen, fuel, water, oils, &c., but not wear and tear. Can raise or lower men to 2,000-foot level, in four minutes, for 6 cents per man.

The cost of pumping the past year at Yellow Jacket mine has been very small. Have not run pumps for sixty days at a time. Water of whole mine has not exceeded 1 inch (miner's measure, 6-inch pressure) the whole year.

The water in the mine has decreased from 20 inches, at 250-foot level, to less than 1 inch, 1,130-foot level; (miner's measure, 6-inch pressure.)

The cost of milling at present is \$12 per ton. Cost of transportation to river mills is about \$2 50 per ton; to steam mills within county lines, about 60 cents per ton. Cost of transportation, included in cost of milling ore, \$12.

Cost of running two of Root's patent blowers, No. 3 and No. 5, is about \$12 per day. Carry air to four different points; nearest 1,300 feet from blower; most distant 2,200 feet. I am unable to state how long a time it will take to exhaust all profitable ore above 600-foot level, or between 600 and 1,000 foot levels. I am ignorant of the quantity in place.

The present machinery in use at the mine, with addition of necessary pumps, ropes, &c., will be available for hoisting and pumping to a depth of 2,500 feet from surface.

The width of the lode at the various levels has never been definitely determined. Have made a cross-section of over 400 feet on 1,000-foot level without finding either side or wall. Productive vein-matter has varied from 12 inches to 24 feet in width.

The cost of prospecting the mine the past year has been about 30 per cent. of the whole expense of mine for labor and cost of materials, or say \$172,000.

Pay-ore has been very regular from the surface to 1,100-foot level.

You will please excuse my tardiness in replying to your various questions. Absence and want of time are my only excuse.

Yours, respectfully,

THOMAS G. TAYLOR, *Superintendent.*

Brevet Major General H. G. WRIGHT,
Sutro Tunnel Commissioner.

APPENDIX J.

OFFICE OF STATE SURVEYOR GENERAL AND LAND REGISTER,
Carson City, Nevada, November 8, 1871.

SIR: In reply to your inquiries, hereinafter given, and numbered from 1 to 7, I have to make the following report:

"1st. The fall of Carson River from the Mexican Dam to the best location for a large dam above and nearest to Dayton. (This is probably at the point where the Franklin Mill-dam now is.)"

The fall is 155 feet from Mexican Dam to the Franklin Dam.

"2d. The fall of Carson River from the point selected for a large dam to a point opposite the Sutro Tunnel."

The point selected is the Franklin Dam. Fall of river from this point to a point opposite Sutro Tunnel is 100 feet.

"3d. The height of high water in the river when highest and when lowest; also the height in each month of the year, if possible to be ascertained, and the rapidity of flow at these different times."

The average flow, taking one year with another, is as follows, estimated in square-foot section, with a velocity of four miles per hour: In the month of May, 600 square feet; in June, 700; in July, 700; in August, 600; in September, 500; in October, 500; in November, 400; in December, 400; in January, 400; in February, 400; in March, 400; and in April, 500. This gives an average monthly section of 508.33 square feet, with the velocity as above given. The perpendicular rise and fall of the river per month cannot be given, but the extremes of highest water in floods and lowest water in drought are from 8 to 10 feet in the average width of the channel.

I would state that the amount of water flowing in the Carson River this year is extremely small—far less than ever known since the settlement of the State; and it is not probable that a similar reduction will happen in many years. I have, therefore, based no estimate or calculation upon this year. For the months of August, September, and October, and up to the present time, the flow has been only 25 cubic feet on a grade of 10 feet to the mile.

"4th. The cross-section of the river, at the best point for a large dam, to be sufficiently large and high to hold all the water to the level of the Mexican Dam."

This cross-section is selected as the Franklin Dam, and is shown on accompanying diagram.

"5th. Approximate area in square miles of the reservoir or lake thus created."

Exclusive of any overflow at the town of Empire, a tract 15 chains wide, and eleven and three-quarters miles long from Mexican Dam to the proposed large dam, the surface of water thus created would be 1,410 acres, or two and one-fifth square miles.

"6th. Estimated dimensions and cost of dam to answer the above purpose."

This dam should be 837 feet long and 155 feet high, (see accompanying diagram,) and would cost not less than \$200,000. But by moving the site one mile up the river from the Franklin Dam, the dimensions and expense would be greatly reduced.

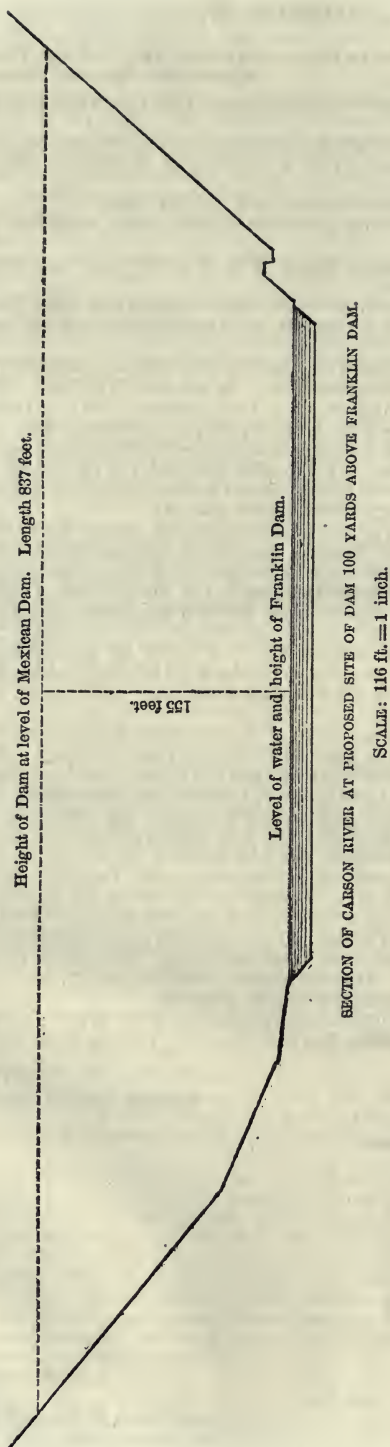
"7th. Length of canal from location of dam to the mouth of the tunnel, including its windings in following the horizontal curve; also, size of canal in order to carry off the average and accumulated flow of water; also, estimated cost of construction of canal."

The length of canal would be five and one-half miles. The size of canal would be a cross-section of 600 square feet. The cost of construction of canal, taking a mean average between excavating and fluming, would be \$250,000.

With the exception of the fall of river and distances herein given, the estimates could only be approximated; want of time has prevented my making a careful and accurate estimate.

JOHN DAY,
Surveyor General State of Nevada.

ADOLPH SUTRO, Esq.,
San Francisco, California.



APPENDIX K.

[2,185 feet of tunnel, (including open cut,) cost, \$42,800 78; commencing October 20, 1869; ending July 1, 1871.]

Character of ground developed.	Respective distances.	Average cost of sup'f. foreman, and labor per foot.	Total cost for superintendent, foreman, and labor.	Average cost for frame-timber per foot.	Total cost for frame-timber.	Average cost of iron, steel, tools, oils, and candles per foot.	Total cost of iron, steel, tools, and candles.	Average cost of track-timber per foot.	Total cost of track-timber.	Average cost of track-iron per foot.	Total cost of track-iron.	Average cost of wood per foot.	Total cost of wood.	Average cost of charcoal per foot.	Total cost of charcoal.	Average cost of powder, fuse, and caps per foot.	Total cost of powder, &c.	Average cost per foot.	Total cost for completing 2,185 feet of tunnel.	Total number of days worked by miners alone.	Total length of calendar time.	Average feet of tunnel each day.
Trachytic conglomerate.	750	\$14 10	\$10,574 00	.....	.....	\$1 00 +	\$757 +	Cts. 17.87	\$134	\$177 +	Cts. 14	\$105 +	Cts. 14	\$37 50	\$15 70	5	200	18 82 +	\$1,775	1,255	109	7
Trachyte	500	16 87	8,435 00	.....	.....	1 00 +	504 +	17.87	89 +	22 31	111 +	70	.....	40	200	18 82 +	200	18 82 +	9,413 30	1,140	104	5
Trap dike.	40	12 84	513 60	.....	.....	1 00 +	40 +	17.87	7 15	22 31	82 72	11	.....	4	46 3	16 60	1 20	16 60	664	138	14	4
Red clay	70	16 55	1,158 50	.....	.....	1 00 +	70 +	17.87	12 50	22 31	15 61	72 11	.....	3	7 80	20 31	2 10	20 31	1,421 70	112	14	4
Blue clay	100	18 36	1,836 00	.....	.....	1 00 +	100 +	17.87	17 87	22 31	22 31	72 11	.....	3	11 15	22 12 +	3 00	22 12 +	2,219 25	966	98	3
Porphyry, timbered	342	18 44	6,306 48	.....	.....	1 00 +	342 +	17.87	61 19	22 31	76 30	72 11	.....	50	68 40	23 02	171	23 02	7,783 92	764	138	2.5
Porphyry, hard	383	19 05	7,296 15	.....	.....	1 00 +	386 30	17.87	68 35	22 31	85 45	72 11	.....	63	76 60	23 02	30	23 02	8,431 17	773	143	2.7
Extra, for open cut	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,089 44	.....	.....	.....
Total	2,185	.....	36,118 73	.....	816 96	.....	2,204 62	.....	390 16	.....	496 59	.....	674 24	.....	343 41	.....	657 24	.....	42,800 78	4,448	546	4 +. 15

Respectfully,

The Honorable THE SUTRO TUNNEL COMMISSION.

J. C. HAZLETT.

APPENDIX L.

The following estimate is based upon four miles or 21,120 running feet of the Sutro Tunnel complete :

The large timbers are 12 inches square, and are set 5 feet apart from center to center.

The lagging are 3 inches thick, 6 inches wide, and 5 feet long, containing lumber as follows, to wit :

	Feet.
4,225 bents, containing 840 feet each.....	3,549,000
4,225 bents lagged, containing 570 feet each.....	2,407,680
8,450 supports for track, containing 36 feet each.....	304,200
84,480 lineal feet, or 16 miles, track timber, 6 by 6.....	253,440
Total feet.....	6,14,320
At \$40 per M.....	\$260,572 80
4,225 bents properly in place, at \$25 each.....	105,625 00
Total cost.....	366,197 80
Cost per linear foot.....	\$17,33.88

Respectfully,

J. C. HAZLETT.

The Hon. THE SUTRO TUNNEL COMMISSIONERS.

APPENDIX M.

SAN FRANCISCO, CALIFORNIA, November 23, 1871.

MY DEAR SIR: It was my intention to avail myself of the opportunity to present some additional statements in regard to the Sutro Tunnel, but my time has been so very much occupied since my return to California that it has been almost impossible for me to find the necessary leisure.

I think now that I shall have to reply to the statements of some of the superintendents of the mines on the Comstock lode after your report is published, so I may ascertain what position they take; my reply, of course, can then form no part of your report.

You are, no doubt, well aware of the continued and persistent prevarications of the men who oppose the great work in which I am engaged; and since I have given a complete history of the tunnel enterprise and the motives for that opposition in a speech delivered by me at Virginia City, Nevada, some time ago, I inclose a copy of the same, and would respectfully ask to have the same embodied in the appendix to your report.

That a work of the magnitude of the Sutro Tunnel, which will radically change the mode of working the mines, should find much local opposition, cannot be wondered at. It is the old fight of stage-coaches against railroads, and such fights will always take place as long as improvements are contemplated.

I forwarded to you some days ago estimates of the cost of large dam across Cañon River, with other statistical information about the water-power on the river, which I hope has duly reached you.

I am, dear sir, your most obedient servant,

ADOLPH SUTRO.

Major General H. G. WRIGHT,
Senior Officer Sutro Tunnel Commissioners.

SPEECH OF ADOLPH SUTRO, ON THE SUTRO TUNNEL AND THE BANK OF CALIFORNIA.

FELLOW-CITIZENS: For some years past I have been closely identified with an enterprise which has a vital bearing upon the prosperity of this section of country, and if I appear before you now for the first time in my life as a public speaker, it is with a thorough conviction that upon its success depends your future welfare.

You have all heard of the Sutro Tunnel, but I believe there are many among you who do not entirely understand its importance, and the great results which must flow from its construction. If you will have a little indulgence with me then, I shall try

to explain to you what the tunnel will accomplish, what has thus far prevented its construction, and show you that by joint action you can easily consummate and carry out what appears to be a gigantic undertaking.

It will become necessary, in the course of my remarks, in order that you may properly understand this tunnel project, to expose some of the doings of an institution called the California Bank. I shall tell the truth, without fear or reservation, for I have come here to "fight it out on this line," and I intend to do so, "though the heavens fall."

About ten years ago, Peter O'Reilly discovered the existence of silver on what is now known as the Comstock lode, the richest silver vein of which there is any record in ancient or modern history. Work during that space of time progressed rapidly, and where it was an easy task to extract the minerals from these mines in the beginning, it is now one of extreme difficulty. They have reached an average depth of probably 1,000 feet, and we find that nearly fifty steam-engines are required to pump out the water and hoist the ore. The expenses of keeping so much machinery in motion is immense, and even at this present time they absorb so much of the profits that it has already become unprofitable to work some of the mines.

It is not only the original cost of the machinery and the enormous consumption of fuel, in a country where no coal exists, but the constant additions, the wear and tear of engines, boilers, cables, cages, &c., &c.; the vexatious delays by breaking down; the lengthening out of the pumps, pipes, and rods; the excavations for and the construction of pump-bobs; the engineers, firemen, and other attendants required; in fact, the innumerable and constant expenses connected with the operation of extensive and heavy machinery, which has to be increased for every foot of descent, and which makes it only a question of time when these mines will have to be abandoned, no matter how rich the ore.

In addition to all this, we find that the heat at the present depth has so much increased that, notwithstanding the improved ventilating apparatus, the men can do but one half the work they could in a cool, healthy atmosphere, and the loss in consequence is more than a million of dollars per annum.

Is it any wonder, then, that these, the richest mines in the whole world, will no longer pay under the present unwise system of working? You are told that in order to make them profitable again your wages must be reduced, and next in succession you will be told that white labor does not pay any more at all, but that Chinese must take its place. If the mines do not pay now, what will be their condition in two or three years from now? If it requires from forty to fifty steam-engines to work them at a depth of 1,000 feet, how many will be required at a depth of 1,500 or 2,000 feet? If the thermometer now stands at 95 or 100 degrees Fahrenheit, and the miners become consumptive for the want of oxygen in the air, and can do but one half their usual amount of work, what will become of them at that greater depth? Will it be possible to work them at all?

I might cite numerous instances of mines in Mexico, and all parts of the world, which had to be abandoned on account of the rapidly increasing expenses as depth was reached, but I cannot go into these details on the present occasion; all I can say to you is, that experience in all places and at all times has shown that mines at some time do reach a depth *where the constantly increasing cost of mining exceeds the yield*, and hence we find that during several thousand years of mining operations, even by means of tunnels and other auxiliaries, the greatest depth that has yet been reached on any mine in the world is but 2,700 feet.

The laws of nature and of mechanics are alike everywhere, and it is my firm belief that some of the mines on the Comstock lode have already reached a depth where it no longer pays to work them, and that they all will reach that depth before a deep tunnel can possibly be completed. What then will become of the once flourishing counties of Storey, Ormsby, Lyon, Washoe, and Douglas, which almost entirely depend on the produce of these mines? Is it not proper that every good and well-thinking citizen should earnestly reflect upon the fate that would overreach this commonwealth should that great and only source of our prosperity cease to exist?

There would no longer be employment for the miner, the laborer, the mill-hand, the carpenter, the blacksmith, the mason, the teamster. No longer would there be any one to support and patronize your newspapers, groceries, bar-rooms, hotels, livery stables, express companies, assay offices, dry goods, clothing, millinery, drug, hardware, cigar, fruit, and book stores.

Your dwelling-houses would be deserted; your stores without tenants; your real estate valueless; your mills would be idle; no more lumber would be required; your farmers and gardeners would no longer have a market; your State government would commence to totter; the assessor would find his assessment-roll grow gradually less; the treasurer would see his cash account diminish in the same proportion; your State credit would be sadly shaken; the people in the mining districts of the eastern portion of Nevada would have to bear the whole burden of taxation to support the govern-

ment and to pay the interest on the State debt, and bankruptcy, ruin, and desolation would be brought upon a once flourishing country.

This is a sad picture; it is its darkest side; but is it not well, while we are still in a condition to act, while we have sufficient strength left to go to some exertion, while we have the means for self-preservation, to look the enemy boldly in the face and devise such means as will avert the calamity?

The only remedy which presents itself, sure and certain in its operations, is the construction of the Sutro Tunnel. The day work is commenced on that tunnel, with a reasonable prospect of completing it, that day you give a new lease of life to this section of country. From that day on you instill new confidence into the future; from that day on your real estate and other property will once more assume a value, and people will no longer say to you, as nine out of ten do now, that they are going to leave the country in a few months.

Great tunnels have been constructed for centuries in all countries where mining is carried on intelligently, and they have accomplished precisely what we desire to accomplish here. I might give you instances of tunnels constructed, three or four times the length of the one proposed here, while they gave but one-sixth the depth; I might relate to you the magnificent results obtained from their completion; I might tell you of the enormous fortunes which were obtained thereby, and give you many other interesting particulars were it not for the want of time to-night.

The Sutro Tunnel, starting at a point near Carson River, will reach the Comstock lode in a distance of 20,178 feet, and cut the same at a perpendicular depth of 1,922 feet, or a depth along the dip of the lode of 2,900 feet below the floor of the Gould & Curry Company's former office. In order to expedite the work, four shafts will be sunk on the tunnel route, from the bottom of which, at the proper depth of the tunnel level, drifts will be extended in each direction. After reaching the Comstock lode, the tunnel will be continued northerly along the lode to and beyond the Sierra Nevada mine, and southerly along the lode to and beyond American Flat.

A very elaborate report was made some time ago by R. G. Carlyle, esq., an engineer of a high order of ability, on the details of construction and cost of the tunnel; his report covers about 200 foolscap pages, is full of illustrations, and in its details altogether a creditable and reliable work; his estimate gives the cost of the tunnel at about \$100 in gold per foot, which, probably, is somewhat below the mark, taking into consideration the unknown difficulties usually encountered in such extensive works; he estimates the time necessary to complete it at two and a half years.

The principal advantages this tunnel will create, as far as mining operations on the Comstock lode are concerned, may be enumerated as follows:

First. All pumping-machinery may be dispensed with as soon as the tunnel is completed, for the shafts now existing on the Comstock lode may at once be connected with the tunnel by boring, which is at the present time accomplished rapidly, and at small expense, thus draining off the water from the shafts and permitting their connection with the tunnel without delay.

Second. The moment this connection is accomplished the most perfect ventilation is insured—drawing off the fumes of powder like a chimney would 2,000 feet in height, cooling the atmosphere, giving health and vigor to the miners, and preserving the timbers.

Third. The mines may thereafter be opened by numerous stations or galleries to the whole depth of 2,900 feet, thus showing the different bodies of ore contained in the mines, exposing many millions of treasure to the eye, and increasing their value in proportion.

Fourth. It will give a great impetus to the exploration of those mines which have thus far been unproductive, particularly those north of the Gould & Curry mine, and those on American Flat, which, to a large extent, have been lying idle on account of the great burden of exploring an unproductive mine through perpendicular shafts.

Fifth. For the reasons already stated, the extraction of ore will be so much facilitated and stimulated that the present production of twelve or sixteen millions of bullion may be increased to, or even be made to exceed, fifty millions of dollars per annum.

Sixth. Not only the pumping-engines may be dispensed with, but also those for hoisting; for after the shafts are connected, instead of hoisting the ore to the surface, and transporting it by means of wagons or railroad to the mills on Carson River, at an expense of at least three dollars per ton, it will fall down to the tunnel level by its own gravity, at no expense at all, while a railroad in the tunnel, but four miles in length, can deliver the ore at the mills on Carson River at an expense of twenty cents per ton.

Seventh. By this great saving in extraction and transportation, and the abolishment of all steam-hoisting and pumping engines, which now eat up all the profits, it will be made possible to take out the immense bodies of low-grade ores, assaying from \$2 to \$20 per ton, and which are known to exist on the Comstock lode, and which may be

concentrated by means of the water which the tunnel itself will furnish. Five hundred millions of dollars, at a low estimate, contained within this mountain, without the tunnel, will forever remain slumbering in the bowels of the earth, for the expenses of extraction, under the present system, are greater than the value they contain.

Eighth. After the completion of the tunnel the mines may, without the use of steam-engines, be worked to great depth below the level of the tunnel, by conducting through pipes the water which may be collected on the surface from melting snow and rains, together with that contained in the mines, to hydraulic engines, or turbines, placed at the bottom of the shafts at the tunnel-level, thus using a portion of the very water which costs so much to pump out at present, as a most economical and useful motive-power to propel pumps, which raise the water from great depths below and discharge it through the tunnel.

Professor Weissbach, the best living authority, gives the power furnished by fifty gallons of water per second at 1,800 horse-power, at a depth of 2,000 feet—more power than all the engines have now in operation upon the Comstock lode. It may safely be stated, therefore, that by means of the Sutro Tunnel the Comstock lode may be profitably worked to a depth of at least 3,500 feet—a greater depth than has yet been reached in any mine in the world.

Ninth. Where only 2,000 men are now employed, at wages which may be cut down at any time, after the completion of the tunnel more than 10,000 would find profitable employment on the Comstock lode alone. The cost of mining would be so much reduced that those mines which now barely pay expenses would be enabled to pay regular dividends, and allow liberal wages to the men employed.

Tenth. The construction of the tunnel, giving a future to this country, would enhance the value of all property, restore confidence, and place the affairs of the people on a sound and solid basis.

While the tunnel would create a revolution in operations on the Comstock lode and secure the future of these mines for fifty or a hundred years to come, it will carry with it still more important results.

I now approach a subject which may properly be looked upon as the most important feature of this tunnel enterprise. I refer to the discovery and development of mines along the tunnel route, granted by act of Congress to the extent of 4,000 feet in length on every lode discovered.

The proposed tunnel will penetrate to the very center of this great silver-bearing mountain containing the Comstock lode, and traverses a country chiefly consisting of greenstone porphyry, a formation pronounced by Humboldt and others to be eminently productive of silver mines.

It is a fact well known to every miner that many lodes exist which do not reach up to the surface, and which are usually discovered accidentally, while running drifts or tunnels for some other lode; in miner's parlance, they are called "blind lodes," an expression derived from the fact that they are not visible at the surface. Upon these blind lodes the miner builds his hopes; they give him nerve and perseverance to follow his toilsome labors; their mysterious existence, the wealth which they are presumed to contain, and the uncertainty of their precise location, have a powerful bearing on the imagination of man, and are the levers which induce the undertaking of tasks by even single individuals from which they would otherwise shrink.

In a mineral-bearing region the hopes of discovering and opening valuable mines by running horizontal adits into a mountain are generally well founded; but nowhere on the face of the earth do we find a mountain range containing a vein as valuable as the Comstock lode, and a formation equally favorable for the existence of a series of mines. It is not only reasonable to suppose, but quite evident, that the immense convulsion which rent the earth in twain, and created the fissure which is known as the Comstock lode, at the same time must have cracked and opened the earth's crust in many other places.

These are only theories, but they are theories believed and adopted by every scientific man, and by every common miner, and confirmed by experience. It may, therefore, safely be predicted that the proposed tunnel, which will penetrate to the very bowels of Mount Davidson, will discover and open more treasure and wealth to the east and west of the Comstock lode than were ever before discovered by any work of this kind.

Independently of the large revenue the Tunnel Company will derive from draining the Comstock lode; from the transportation of men, ore, rock, and timber, independently of the great value of the company's land, and independently of any other consideration, the discovery and development of the mines contained in this argentiferous belt would justify the construction of this tunnel, simply as an exploring work, and for that purpose alone it should be looked upon as one of the best planned, legitimate, and promising mining enterprises ever undertaken in any mining district.

And now, fellow-citizens, allow me to give you a short history of my struggles in connection with this tunnel project, and let me explain to you what causes have prevented its success thus far.

On the 4th of February, 1865, the legislature of Nevada granted a franchise, giving

me the exclusive right of way for fifty years, for the construction of a tunnel, commencing in the foot-hills near Carson River, to and beyond the Comstock lode. The charter did not specify any rates for drainage or other services, but left that open to private agreement by the mining companies.

I now invited all parties who wished to do so to join in the enterprise, and an association was formed under the name and style of the Sutro Tunnel Company, of which William M. Stewart, our present Senator, was duly elected president. A proposition was submitted to the mining companies "that the Sutro Tunnel Company would agree to raise the funds for the construction of the tunnel abroad, in quarters where cheap capital abounds, provided the mining companies would agree beforehand to pay certain rates of charges for drainage and otherwise after the tunnel should be completed and actually benefit them."

When the necessity and importance of the tunnel, and the immense advantages which would be derived therefrom by the stockholders of the mining companies, had been thoroughly explained, which, however, required a number of months, contracts, drawn by some of the best lawyers of San Francisco, were adopted and signed by the following-named companies on the Comstock lode:

Ophir, Central, California, White & Murphy, Best & Belcher, Gould & Curry, Savage, Hale & Norcross, Chollar-Potosi, Alpha, Bacon, Gold Hill Quartz Mill and Mining Company, Confidence, Imperial, Empire, Yellow Jacket, Crown Point, Belcher, Overman, and by several private individuals owning claims.

Under these contracts, the companies agreed, and made the fulfillment of the terms a mortgage upon their respective mines, that they would pay to the Sutro Tunnel Company forever, for every ton of pay ore extracted from any part of the mines, whether from the surface or through the tunnel, two dollars, from the time the tunnel or its branches should perpendicularly reach under them, or should actually drain the mines. There were other charges provided for for the transportation of rock, timber, men, &c., &c., which need not be enumerated here; it must suffice to state that, under these contracts, at the rate of production at that time, the mining companies had agreed to pay to the Sutro Tunnel Company at the rate of about \$7,000 per day, while these daily payments, after the tunnel should increase the production, were expected to reach \$20,000, and still make a saving of twice that amount to the mining companies, by means of the immense advantages the tunnel would furnish. After these contracts were duly signed, sealed, and delivered, in triplicate, one copy being retained by the mining companies, one copy deposited in the vaults of the Bank of California at San Francisco, and one copy being delivered to the Sutro Tunnel Company, I started, as the duly authorized agent of all concerned, for Washington, where I arrived in June, 1866, expecting to obtain from Congress such additional privileges and rights as Congress alone could grant, (the title to all public lands and mines in this section still being in the Government,) and as were considered necessary in order to obtain the required funds for the construction of the tunnel.

After some efforts, a law passed the United States Congress, which was approved by the President of the United States on the 25th day of July, 1866, giving to me, my heirs, and assigns, (in trust for all concerned,) the following important rights:

First. The right of way forever, from the foot-hills on Carson River, to and beyond the Comstock lode, and on any lode which should be cut or discovered by the tunnel.

Second. The title to 1,280 acres of land at the mouth of the tunnel.

Third. The title to all the mines which should be cut by the tunnel, and which were not already owned by others at that time.

Fourth. It compelled the mining companies, those who had signed the contracts, as well as those who had not, to contribute forever the rates of charges named in the aforesaid contracts, and it made their title subject to that condition.

Congress, in this last section, assumes the function of regulation or administration of the mines in an important argentiferous locality, by recognizing the necessity and importance of a deep tunnel and the equitable adjustment of payment therefor. The rates to be paid to the tunnel company might as well have been named in the act, but Congress preferred to simply refer to the rates named in the contracts, as agreed upon by the mining companies, and in consideration of the immense efforts which had already been made, and which were supposed to be required to carry out so gigantic a work, imposed no clause of forfeiture, but declared all the rights granted as vested forever in the grantee.

Thus fortified with a most valuable mining grant, the first one ever made by this Government to an individual, and provided with other privileges worth several millions of dollars per annum, I proceeded to New York, expecting to raise the requisite funds without any difficulty.

The whole merits of the enterprise were fully set forth in a pamphlet published by me and submitted to the first and wealthiest men of that great metropolis, among whom were Commodore Vanderbilt, William B. Astor, and many others, but, in every instance, one obstacle presented itself, and that was, that if the statements made were correct, there could be no difficulty in so magnificent an undertaking to raise some of

the funds, even if it be but a small portion of the sum required, at home, and I soon became convinced that this was the only true course to be pursued. I requested these gentlemen to express their views in a communication to me, which might be submitted to the people of California and Nevada, and, as a consequence, they addressed to me the following letter:

"NEW YORK, October 5, 1866.

"DEAR SIR: We have carefully examined your project for a draining and mining tunnel to the Comstock lode in the State of Nevada, and consider the same an enterprise which, in our opinion, when carried out, will prove of incalculable benefit to the mines on that lode, and at the same time may be a source of large revenue to the parties undertaking it.

"We have taken some pains to ascertain what chances exist in this city to obtain the necessary capital, and have come to the conclusion that you will find it a matter of serious difficulty to convince the people of New York at large of its value; the principal and, in our opinion, fatal objection to its success here at present being the fact that no portion of the capital has been subscribed on your coast.

"If the mining companies on the Comstock lode, and the people of Nevada and California, who are familiar with the value of your mines, would evince their confidence in this enterprise, by subscribing a portion of the requisite capital, say \$400,000 or \$500,000, and work on the tunnel is actually commenced, we think you will find comparatively an easy task to obtain the balance of the funds here.

"We would consequently advise you not to lose any valuable time in futile attempts here or in Europe, where, no doubt, the same objections will be raised, but to return at once to San Francisco and use your efforts there to get the work started.

"Let some of the leading men on your coast, who are known here for their commercial standing and their integrity, form a preliminary board of directors, and you may then, while the tunnel is daily progressing, return to New York, we think, with confidence of success, and we shall use our best efforts to assist you in accomplishing your object.

"Your perseverance and the practical and able manner in which you have presented this laudable undertaking to the public deserve our commendations, and it shall be a source of gratification to us to see your labors crowned with success.

"We are, dear sir, respectfully yours,

"Samuel Willets.

"Daniel T. Willets.

"J. H. De Bevoise.

"John Silsby.

"W. S. Martin.

"Eugene S. Ballin.

"John T. Martin.

"B. Silliman.

"Emil Heinemann.

"Daniel H. Temple.

"J. H. Coghill & Co.

"J. Perry, Jr.

"Polhamius & Jackson.

"Mott & Justh.

"Theodore F. Lewis.

"John T. Daly.

"D. Appleton & Co.

"Wm. Aufermann.

"Z. Dederick.

"J. & H. Greenbaum.

"M. Herzog.

"Moses Taylor.

"Peter Cooper.

"August Belmont.

"J. & Wm. Seligman & Co.

"Eugene Kelly.

"R. C. Fergusson.

"Wm. T. Coleman.

"C. K. Garrison.

"Duncan, Sherman & Co.

"Francis Skiddy.

"Johnson & Lazarus.

"Wm. B. Ogden.

"J. C. Fremont.

"R. L. Cutting.

"David Hoadley.

"C. P. Huntington.

"Geo. A. Freeman.

"Sam'l L. M. Barlow.

"M. Morgan's Sons.

"A. SUTRO, Esq."

It is evident that the persons who signed that letter, representing probably \$100,000,000, looked upon the enterprise as too magnificent altogether, which created the suspicion that something was behind the scenes, and they naturally wanted a substantial indorsement out here.

So, in August, 1866, I concluded to return to San Francisco, in order to follow out the suggestions made in the aforesaid letter, and submitted the matter to the mining companies and to many of the principal merchants of San Francisco.

While this question was under consideration, the legislature of Nevada, which was then in session, passed a memorial and resolutions, asking Congress to loan its credit to this important work, in case sufficient capital could not be secured from private sources, and in a lengthy report set forth its reasons why the nation should feel a deep interest in its execution.

The question as to subscriptions to the Tunnel Company by the mining companies had in the mean time been fully discussed in San Francisco; and after some delay a number of companies agreed to and did subscribe through their trustees sums aggre-

gating together, with subscriptions from private persons, about \$600,000, and there was every prospect of seeing them increased in a few weeks to \$1,000,000 or more in San Francisco alone.

But now commenced the tug of war; at the very moment when I was on the full road to success, when everybody commenced to look upon the whole affair as quite sure of being consummated, and when I myself was led to think that my struggles were about over, they only fairly commenced.

It was at this time that the California Bank ring stepped in, and in high conclave and in secret session concluded that it was high time to break me up, for my efforts were about to be crowned with success, substitute themselves into my place, reap the fruits of my labors, and, by their influence over the politicians of this coast, obtain the aid of Congress which the legislature of Nevada had applied for.

This conclave was held in San Francisco on the 6th of June, 1867, the night before the annual election of trustees for the Crown Point mine; and when that election took place, in which the former president of the company, A. H. Barker, and their superintendent, Batterman, were turned out, and the bank ring took possession, a subscription to the tunnel of \$75,000, which had previously been agreed upon by most of the parties interested, was voted down.

I saw at a glance what was up. The bank, which up to that time had warmly supported me, had now turned against me, and I knew quite well that none of the subscriptions already made by the mining companies would be ratified at their stockholders' meetings. Nearly all the persons who had previously stood by me deserted me; they shunned me on the streets and avoided me as if I had an infectious disease; every miserable cur and hireling of that bank turned the cold shoulder on me—actually afraid their masters might be displeased at seeing them talk to me—and for the first time I commenced to feel and appreciate the immense, overwhelming, and ramified power that concern wields. Men knew, as if by magic, that the bank was now against me; it seemed as if they all had been informed of it at once, and through some invisible power had received their instructions.

It became evident to me that the ring entertained the opinion that their combined efforts must soon crush me out and use me up financially, physically, and mentally, in such an unequal contest. But they had got hold of the wrong man; I was not so easily to be disposed of. When I found that these traitors, after having signed contracts, after having urged and helped me on to expend mine and my friends' money, after having induced me to labor almost day and night for several years, which I did with zeal and enthusiasm—I say when I found that they were determined to rob me of my labors, I made up my mind that they should not succeed in their efforts. I was determined that this base, unscrupulous, and mercenary combination should not carry out its purposes, and made a sacred vow that I would carry out this work if I had to devote the whole balance of my life to it, and defend my rights as long as the breath of life was in me.

I soon found that I had no longer any chances on this coast; I knew that my opponents could easily keep those connected with them, directly and indirectly, from having anything to do with the affair, and also knew full well that by throwing cold water on it, or by declaring it visionary or impracticable, they could prevent those not fully understanding its merits from entering into it, and those who did understand it by bullying and threatening them. And how eagerly did the empty-headed, the brainless, the ignorant, and the envious join in the chorus! this same class who have opposed every great work from time immemorial! this same class who opposed railroads, and steamboats, and telegraphs, and sewing-machines! this same class who opposed and fought the Erie Canal! this same class who a few years ago would ask on every occasion whether you expected to live long enough to see the Pacific Railroad completed!

The difficulties and obstacles seemed to increase and accumulate, and almost appeared insurmountable. How was I to convince people of the contrary, when the most successful men in the country told them not to touch the affair? And how easy was it for them to play upon the prejudices of people when I asked them to invest their money; how easy was it for them to throw out a hint that nobody had any confidence in me?

They found no difficulty in getting the gas and water companies of Virginia City, and all the men under their influence, to tell people the town would be ruined; that it would move down to the mouth of the tunnel; that real estate would become valueless, with many other groundless objections. But did they tell you that without the tunnel the mines would be abandoned and ruin and desolation be brought not only on Virginia City, but upon the whole country?

Fellow-citizens: Have you ever been in a position where your friends shunned you? If you have, you know how mortifying it is on meeting an old acquaintance to have him pass by pretending not to see you, instead of shaking you by the hand and welcoming you. Have you noticed them cross over on the other side of the street when they saw you at a distance? Have you seen their nervous hurry, trying to get off,

when you happened to engage them in conversation? You may possibly have made similar experiences if you were ever broke and your good friends were afraid you might ask them for a loan.

In my case some narrow-minded people may have avoided me, thinking I might urge them to become interested in the tunnel project, but these were comparatively few; the mass of these men knew the bank was against me, and that was sufficient for these servile and timid creatures to insult and avoid me. But I looked upon them with contempt; I had the satisfaction of feeling in my own heart that I was working for a good and noble cause; I knew that the execution of the work I proposed would be a blessing to the men compelled to toil in these mines, and of great and lasting benefit to a whole people. So I continued my efforts, believing that truth is mighty and will prevail, and that in the end my enemies must come to grief, and victory should be mine!

I concluded to give up the field, for the time being, to my opponents, return to New York and go over to Europe if necessary, and see what could be accomplished there. In July, 1867, I arrived at the former place, but soon found that after my apparent failure to raise any funds in California, it was useless to waste my time there. Evidences that the war the Bank of California had commenced to wage against me on the Pacific coast should also extend to New York, came under my observation. On the 16th of July, the day after the Savage Company had held their annual meeting, a telegraphic message was received and a placard stuck up in the office of the agents of the Bank of California in New York, Messrs. Lees & Waller, which stated, in large letters, "That the stockholders of the Savage Company, at their annual meeting, had refused to ratify the subscription made by their trustees of \$150,000 to the stock of the Sutro Tunnel Company, and that the same was utterly null and void."

This telegram was intended to caution the people of New York against me, in case I should falsely represent that the Savage Company had subscribed and ratified their subscription of \$150,000. It was a sort of warning, as if sent ahead of an absconding bank clerk, or forger, or criminal, so that it would utterly ruin my prospects, and coming, as it did, from the leading financial concern of the Pacific coast, it certainly had its effect—it put a damper on my prospects, and I determined to make no further attempt in New York at that time.

It almost appeared to me after this, that the only place where I could vindicate myself, and where the importance and magnitude of the proposed work would be properly appreciated, and where, at the same time, the bank would have the least power to misrepresent and fight me, would be in Congress. But Congress was not to meet until December, and this being the latter part of July, I determined upon spending the interval in Europe for the purpose of examining the mines, visiting their big tunnels, consulting some of their great engineers, in order to lay my experiences before Congress, at the same time paying close attention to the facilities which would exist in Europe for securing the required funds. I was supplied with letters of introduction from many of the bankers of San Francisco, which had been furnished me on my first journey east, among which was one from the Bank of California, signed by William C. Ralston, their cashier and chief manager, to the Oriental Bank-Corporation of London, recommending me personally and the tunnel enterprise to their English friends as an excellent investment. This letter, however, I did not of course make use of, after what had transpired, and it remains in my possession now.

I traveled through Ireland, England, France, Belgium, Holland, Prussia, Austria, Poland, Hungary, Bavaria, Switzerland, and Italy, visited many of their mines, was received with great courtesy, and came in contact with many of the leading financial, political, and scientific men of Europe. I descended into their deepest mines—the deepest in the world—and after all my investigations became more and more convinced of two things: 1st, That mineral lodes, true fissure-veins, as shown by all experience, descend downward indefinitely; and, 2d, That in order to work mines rationally and profitably, wherever the topography of the country allows it, great district or main tunnels, which serve as highways under the mountains, must be constructed.

I entered into correspondence and had personal interviews with such men as Von Cotta, the geologist; Weissbach, the engineer; Baron Von Beust, of Saxony; Chevalier, the French senator and political economist; Sir Roderick Murchison, president of the London Geographical Society; John Stuart Mill, member of Parliament; Von Dechens, the friend of Humboldt; Baron Von Hingenau, chief of the mining department of Austria; Burkhardt, Koch, and many others. I submitted my plans to these men, and they unanimously agreed upon the importance, feasibility, and magnificence of the undertaking and addressed to me many complimentary letters.

I found it impossible, however, to raise any funds in Europe for several reasons. In the first place, people there as a general thing have no confidence in our mining laws, as far as security of property is concerned; secondly, they raised the same objection which was raised in New York, that our own people on the spot must first show their confidence by their subscriptions and by commencing work; and, thirdly, at that particular time, if there had been no other obstacle in the way, the threatening

attitude between France and Prussia would have prevented the consummation of any extensive financial operation abroad.

I found but one concern, the house of Erlanger & Co., the great bankers of Paris, who were willing to entertain the project at all; but after sending for one of their London partners, they also concluded it to be impossible to carry out the affair at that time.

So I returned again to the United States, and left Liverpool on the 1st of December, 1867, arriving at Washington just after Congress had met. I now commenced to go to work in good earnest; made the favorable acquaintance of nearly all the members of both Houses of Congress, and the leading men of the nation, and had a fine prospect of success.

It soon became known to the bank out here, through information derived from their spies in Washington, who kept close watch of my doings, that the chances of obtaining a loan from the Government were good, which made them feel quite uneasy, and they immediately sent a number of telegrams to different persons in Washington, one of which reads as follows;

"VIRGINIA, Nevada, January 15, 1868.

(Received at Willard's Hotel, Washington, D. C., January 16, 1868.)

"To Hon. WM. M. STEWART and JAS. W. NYE:

"We are opposed to the Sutro Tunnel project, and desire it defeated if possible.

"WM. SHARON,

"CHARLES BONNER,

"Superintendent Savage Company.

"B. F. SHERWOOD,

"President Central Company.

"JOHN B. WINTERS,

"President Yellow Jacket Company.

"JOHN P. JONES,

"Superintendent Kentucky Company.

"J. W. MACKAY,

"Superintendent Bullion Company.

"THOS. G. TAYLOR,

"President Alpha, and Superintendent Crown Point.

"and Best and Belcher Companies.

"F. A. TRITLE,

"President Belcher Company.

"ISAAC L. REQUA,

"Superintendent Chollar Potosi Company."

This telegram was meant to read as follows: "We are opposed to Sutro getting an appropriation for the Sutro Tunnel; defeat him if possible; that will use him up, and we, Wm. Sharon & Co., will then step in and get it." As a matter of justice, I will here state that the superintendents who signed this document could not well have refused it, and I believe that some of them to-day are warm friends of the tunnel enterprise. It was sheer accident that I got hold of this telegram; how many were sent, together with letters and secret instructions, is impossible for me to tell. I may state, however, that the very next day two more messages arrived in Washington, signed by a number of mining presidents of San Francisco, nearly all well-known tools and blunkies of the bank, one of which was addressed to John Conness, whilom Senator from California, who, in his eagerness to serve his masters, did not hesitate to openly oppose me.

They took so deep an interest in my affairs that they expended over \$100 in two days for these telegraphic messages, while the information they contained could have been conveyed in a letter, more fully, at an expense of three cents.

These telegrams I paid but little attention to. The bank may be a big concern here; at Washington it amounts to but precious little. Whether our Senators were much influenced thereby is hard to tell. I asked no favors from them, and started out to make my own fight.

About this time I published a book of about 250 pages, a copy of which I hold in my hand, containing much information about these mines and others; about the interest Government should feel in the production of precious metals, and distributed 1,000 copies among the members of Congress, the leading men of the country, and the principal newspapers. By getting the book up in elegant style, Senators and congressmen kept it on their centre-tables, instead of condemning it to their paper baskets, as is done with many of the ordinary documents sent to them, and if they did not read it at once themselves, their friends did, who, while waiting to get Federal appointments, had not much to do, and ultimately called their attention to it.

I can best give you an idea of the general argument used in the work by reading to you its introductory, which is as follows:

"The development of the mineral resources of this country forms a subject of such

grave importance, one involving considerations of a politico-economical nature of such significant consequences, that it well behooves the American statesman, the patriot who has the future of this great republic at heart, to devote some time to the earnest examination of those questions which have a vital bearing upon the future welfare of this country.

"In the vast regions stretching from the Mississippi River to the broad Pacific Ocean, from the confines of Mexico to the icy regions of the North, there lie buried in the bowels of the earth incalculable treasures of the precious metals, which but await the industrious application of the hardy miner and the fostering care of a provident government to pour out a stream of gold and silver, which will so much increase the national wealth, augment the resources of the nation, and spread welfare and prosperity throughout the extent of this vast land, that the burdens of taxation will gradually disappear, and make the national debt sink into insignificance. If we contemplate that mighty interest, which can be made to create so many blessings, and find that it is neglected and declining from year to year, we must arrive at the firm conclusion that there is something radically wrong in our present system of mining, and that an immediate, practical and effectual remedy should be applied to rescue from a steady decline and eventual abandonment a source of wealth which must be considered the most fruitful and important one this nation possesses.

"If the facts presented in the following pages are carefully examined, three prominent conclusions will be arrived at:

"1st. That the main wealth of the mineral regions is contained in quartz lodes, the principal treasures of which are found at great depths beneath the surface.

"2d. That the present mode of mining downwards from the surface is detrimental to the prosperity of the mining interests.

"3d. That a system of deep tunneling should be inaugurated, which will make mining profitable by giving a natural outlet to the flow of water, by ventilating the mines, by cooling the atmosphere, and by facilitating the extraction of ore.

"Mining requires capital, which the western regions do not possess; the Eastern States have an abundance, but not for investment in mining enterprises, which are looked upon with suspicion and are almost considered disreputable.

"Some years ago many persons were found quite willing to embark in mining ventures, and considerable sums were invested; but the experiences made have been disastrous and ruinous to those concerned, in almost every instance. This result has been charged to various causes, but the true one must be sought in the unwise, extravagant, and wasteful manner in which the work on the mines has been performed.

"The construction of deep tunnels, which by all authorities are admitted to be absolutely necessary to make mining operations successful, requires time, and the outlay of large amounts of capital, and consequently implicit confidence in the permanency of the mines.

"It is the lack of confidence in the permanency of the mines (their downward extent to great depth not having practically been demonstrated in the United States) which prevents the execution of such works.

"The Comstock lode, the most productive of all mineral lodes in the world, producing as much silver as the whole republic of Mexico, presents the most extraordinary example, illustrating the ruinous and wasteful manner of our present system of mining. We have a lode here which has produced within the last six years over \$75,000,000, and the whole of that enormous sum has been swallowed up by the expenses of producing it. The mines upon this lode have now reached such a depth that, after a few years, they must inevitably be abandoned, provided a deep tunnel be not constructed.

"Great mineral lodes, true fissure-veins, according to experiences made in older countries, extend downward indefinitely; we have the testimony of some of the first scientific men living, that the Comstock lode bears the strongest evidence of being a true fissure-vein.

"Here, then, we have a remarkable state of affairs; a lode yielding \$16,000,000 per annum, almost the whole amount being absorbed by the expenses of producing it, while the construction of a deep tunnel, for which extraordinary facilities exist, would leave a large portion of that amount as a profit; the downward continuance of the lode is theoretically, at the same time conclusively, proven, and still we find that capitalists cannot be found to undertake the construction of a deep tunnel, because the ores at great depth are not actually visible.

"Were that tunnel completed to-day, a glorious reality, pouring out a silver stream of \$40,000,000 or \$50,000,000 per annum, these same capitalists, who first want to eye the riches way down in the earth before they consent to invest, would be eager to enter into similar undertakings in all parts of the mining regions, and tunneling would become the order of the day. The nation would be enriched beyond all expectation, and the benefits to the Government and the people would be incalculable.

"That it is both the duty and the interest of the Government to aid in the construction

of one such tunnel to serve as an index-work, and thereby establish the continuance of mineral lodes in depth, cannot admit of any doubt.

"The most favorable opportunity for such a demonstration presents itself in the construction of the proposed tunnel to the Comstock lode; the Government may consistently extend its credit to that work, for almost no risk is involved, the security offered being a hundred-fold. A simple investigation of the subject will prove this conclusively.

"Some thirty years ago a similar question arose in Saxony, when Baron von Herder, then chief of the mining department, as an introductory to a book on the subject, addressed his countrymen in the following words:

"To the friends of their country do I dedicate the plan of a mining work, the execution of which is of the highest importance to the mining interests of Saxony.

"It is the plan to drive a deep tunnel from the level of the Elbe, near Meissen, to the neighborhood of Freiberg, in order to drain the water from the mines of that district to a much greater depth than heretofore, and by means thereof to secure their existence for centuries to come; a plan which as to magnitude, time and cost, is large and gigantic, but which appears in its effects and results so benevolent and full of blessings, that the question as to cost should not form an obstacle to its execution.

"It is true that the resources of the mining treasury of the Freiberg district are too limited to bear these expenses; but the execution of a work which in times to come will be classed in the list of those great national monuments which have for their object the lasting welfare of a country, and which will secure the same for the latest generations and times, cannot be left to the mercy of a single mining district, but should be looked upon as a work creating happiness and glory, and worthy of the participation and promotion of the entire nation.

"With unlimited confidence do I therefore present to the friends of their country the following explanation and statement of this project.

"May they extend to it a wise and sympathizing examination and magnanimous consideration, and may they be assured of the fervent thanks which posterity will grant them."

"The mines of Saxony produced, and now produce, but a mite of what our mines do; the national debt of that country is but small, and the burdens of taxation are not of an onerous character.

"How much stronger, then, should the argument be in the case at issue! A country containing more mines and richer mines than all the balance of the world combined; a country having a national debt amounting to over \$2,500,000,000, and a people crying out and groaning under unequalled burdens of taxation!

"Wisdom and foresight point out but one course; let the mineral resources of the country go to ruin, and the national debt, the burdens of taxation, and general suffering will be increased from year to year.

"Let our immense mineral resources be developed, an increase in the value of all property, a relief of the burdens of taxation, unparalleled advancement of commerce, industry and traffic, a bright future, speedy resumption of specie payments, and general welfare and prosperity will be the results.

"Those who rule the destinies of this country have the solution of this question in their hands; wisdom, foresight, liberality, and true patriotism will grasp the issue, and promptly secure those results which will immensely benefit our present generation, and extend its blessings to posterity."

The Committee on Mines and Mining, fully appreciating the impetus which would be given to the development of our great mineral resources by the construction of this tunnel, after a most thorough investigation, perfected a bill recommending a loan of \$5,000,000, in twenty-years seven-per-cent. bonds, to be delivered at the rate of \$15,000 for every 100 feet of tunnel completed. To show how thoroughly this committee understood the importance of the proposed work, I will here give an extract from their official report, published by order of the House of Representatives, in which they say:

"Your committee considers the execution of *one* great mining work, such as the proposed tunnel to the Comstock lode, as conducive to the most beneficial results; it would practically demonstrate the continuance of mineral lodes in depth, thereby establishing confidence in the execution of similar works in all the mining districts.

"Writers on mining agree on the importance of general drain-tunnels, and the best proof of their utility is shown by the fact that in those mining districts where a general and extensive system of drainage by tunnels has been adopted, the mines have been kept in a flourishing condition during hundreds of years, while in those places where no tunnels have been made, mining operations have proved unprofitable, and the mines have been abandoned.

"We find in all mining codes provisions for the construction of tunnels; they were, in olden times, called 'the keys of the mountains,' and under the laws of Spain, Belgium, Prussia, Austria, Hungary, Saxony, Hanover, and other countries, compulsory payments toward the support of drain-tunnels were exacted from the mine owners, in order to keep up the mining districts.

"Gamboa, the great expounder of Spanish mining law, in speaking of the neglect of the justices to enforce the construction of tunnels, says:

"By indulging in this neglect of their duty they do injustice to the public, to individuals, and to the rights of the Sovereign, who has made it a law that the working of the mines shall be assisted by means of tunnels, as being works of great importance, and necessary for giving a permanent character to this valuable description of property."

"General drain-tunnels are important in many regards; they not only provide the cheapest and safest means of drainage, ventilation, extraction and discovery of ore, but they accomplish the great and very important result of consolidating the different interest in a mining district, by establishing one general base of operations.

"As mines are worked now, the proprietors or companies, on a mineral lode—no matter how limited the extent of the claims—each, independently of their neighbors, erect a steam-engine, pump the water from their mines, hoist the ore, and transport it to the reduction works; they boast of independent organizations, presidents, boards of trustees, superintendents, secretaries, &c., kept up at an enormous expense, which makes mining unprofitable and a losing business.

"In large cities we find it necessary to establish a joint system of drainage, gas and water works. Main sewers are constructed, into which small branches enter from every building. Supposing each house-owner were to provide his own drainage, independent of his neighbors, establish his own gas manufactory, and dig a canal of his own from a distant spring, in order to get a supply of water, the world would pronounce such proceeding very unwise and foolish.

"And still we find a similar state of affairs in our great mineral districts; a contiguous row of mines on the same lode, each worked independently and entirely regardless of its neighbors, while one general tunnel, or adit, or drain, would allow the water to run off by its natural flow to the lowest level, from all the mines, through one common outlet, thereby abolishing at once all pumping-machinery, giving one common railroad for the transportation of all the ore, and creating innumerable advantages. Only one general mining administration would be required, operations could be carried on jointly and systematically, the extraction of ore largely increased, the health of the miners secured by good ventilation, and large sums of money would be saved, thereby making it possible to extract immense bodies of low-grade ores.

"In short, instead of an unwise, short-sighted, ruinous, and stupid manner of proceeding, we would inaugurate a rational system of mining, a system which would make it profitable, attract the capital which is absolutely necessary for the development of this branch of industry, increase the production of the precious metals beyond all expectations, populate the vast extent of our mineral regions, procure traffic for our trans-continental railways, stimulate the commerce and industry of our whole nation, firmly establish our credit by proving the extent of our mineral wealth, and, above all, relieve the burdens of taxation by increasing the value of all property.

"Such are some of the advantages which, in our opinion, would be derived from the adoption of a general system of tunneling in our great mining districts; and it must appear remarkable that such tunnels, their advantages being so self-evident, have not already been constructed in numerous places."

The measure grew more and more popular, in spite of the secret efforts of the California Bank, and would, no doubt, have passed with a three-quarter vote of the House, had it been possible to reach the Committee on Mines and Mining in the regular order of business.

Unfortunately, when we were almost within reach of the bill, the impeachment trial of Andrew Johnson commenced, and before its weary length was terminated, it was so late in the session that our committee never was reached at all, and consequently the tunnel bill had to go over.

Congress adjourned late in July last year, and I returned to California somewhat disgusted with my ill luck, but never for a moment losing my confidence in ultimate success. Before I left Washington many letters were addressed to me by members of Congress, expressing their regret at my bill not having been reached, and giving it as their opinion that at the next session it would certainly pass. Among these was one from Thaddeus Stevens, one of the very best friends the measure had, who stated that at the next session he would warmly support it; but the old man did not live to see another session; he died within a fortnight.

After spending a few weeks at New York I returned again to California, from whence, after remaining a couple of months, I once more proceeded to Washington to renew my efforts.

In the mean time General Grant had been elected President of the United States, and the misunderstanding which existed between him and Andrew Johnson prevented any special legislation, which, as was stated, might embarrass the former's administration. So Congress concluded to enter into no legislation whatever, with the exception of the passage of some appropriation bills necessary for the support of the Government, and thus the Fortieth Congress expired without acting on my bill.

The new Congress convened on the 4th of March last, under good auspices, and

General Grant, in his inaugural, referring to the payment of the national debt, alludes to the importance of developing our vast mineral resources, and speaks of the treasure-chest which Providence has provided us, buried in our western mountains, for which we must forge the key now to unlock. After a short session of a few weeks Congress adjourned until next December, when, for the first time, I expected to get a fair chance to bring my bill up and have it thoroughly discussed.

I have but little doubt but that, notwithstanding the great efforts the California Bank will make to control the action of both our Senators, they will firmly stand by the people, and use all their influence for the accomplishment of this great work.

In the mean time I have come out here among you, my fellow-citizens, in order to explain to you all about this tunnel business, and while some of the moneyed men of San Francisco look upon the whole thing as a failure, not knowing anything of its history, nor of the great fight of the California Bank ring against it, and which erroneous opinions also many of you entertained, I have more confidence in its success now than ever.

Fellow-citizens, I have come among you to propose to the working people of Nevada to join in together in order to start work on the tunnel itself, and thereby give me that solid indorsement at home, from those who live on the very spot, from the men who work in these very mines, and who are supposed to know most about it, which I have lately sought in vain from the mining companies and from the people which should be most deeply interested. Your solid indorsement will be valued highly at Washington; it will annihilate the efforts of that scheming combination, the California Bank.

Fellow-citizens, it must now be evident to you that the arch enemy of this great work is that hydra-headed monster you have reared in your midst, and allowed to grow into gigantic proportions; that enemy of that welfare of the whole Pacific coast; that incubus upon your prosperity; that crafty concern which resorts to every means to carry out its ends. And why do they oppose the tunnel? Why do they all in their power of cunning and scheming and planning to defeat it? Why are all their satellites and hirelings told they must defeat and oppose the tunnel project with all their might and power, by fair and by foul means? Why do they threaten to discharge their employés if they take a hand in it? And why are they compelled to do all this in the darkness of night? Why is it they dare not make their motives known?

Fellow-citizens, let me enlighten you. Allow me to pierce that darkness and let in a ray of day-light; let me explain to you why these men so bitterly oppose a work which in them, the ostensible owners of the Comstock lode, should find the strongest advocates; let them show to you why they have turned to be the guardians of the Treasury at Washington; let them tell you why they tremble with fear lest work on the tunnel be started; let me explain to you why they make you work in a foul atmosphere, which sends half of you to your graves in the prime of manhood; let me show you why they have allowed forty-two of your miners to be foully murdered at the fire of the Gold Hill mines for the want of an exit through the tunnel; and let me show them to you in their true colors, and then hold them up to the shame, contempt, and ignominy they so richly deserve.

In order to do so I must enter into the details of some of the operations of this clique which rules and controls these mines, and apparently are the absolute owners of a controlling interest in this vast and important property.

Many of you will be utterly astonished to learn that neither the bank nor the mill ring, as a general thing, own more than a few shares in each mine—just about enough to be elected trustees of the companies, while you, the miners and residents of Virginia City, do always own a large amount of stock, and sometimes a controlling interest, in many of the mines. I do not wish to say that the bank ring has not at different times owned large amounts of stock for a number of months, but that was only in such mines as the Savage and Kentuck, for instance, during the years 1867 and 1868, as were then in a magnificent condition, and paying large and regular dividends. But you will say, How is it possible that they can control the elections, put in men of their own ring as trustees, and manage and manipulate these mines as they please, to further their own ends, if they do not own any stock?

That is precisely where the secret lies, and where the public gets gulled and swindled and humbugged, and allows this clique, by sharp practice, to carry out its nefarious schemes.

You all know that there is an institution in San Francisco called the Bank of California; they have a branch house in Virginia City, over which William Sharon presides. The principle upon which this concern is carried on is to get deposits from as many people, and in as large amounts, and from as many quarters as possible; that is where their power lies! Their capital stock is \$5,000,000, with which they do a business of many millions more. They loan out a great deal of money; whether they loan out any of their depositors' money we don't know; but they loan out a great deal; they loan a great deal to their individual members, who are engaged in extensive speculations; some of them pay, but a great many do not; that money is scattered all over creation, and whether it is probable that they could pay all they owe, should they be called upon, I doubt very much. Money in a good iron safe, or

deposited in some of the solid banks of San Francisco, might be a great deal securer. I shall, however, revert to this more in detail on some future occasion.

Among other things, they loan money on mining stocks. The Virginia agent keeps the San Francisco bank well posted on the value of each particular mine, and on the special manipulation going on in it; daily telegrams and letters are sent on the reports of special experts kept for that purpose. This information, which is withheld with the utmost secrecy from the public, enables the San Francisco concern to advance money on stocks, and to brokers, without much risk, while no other bank or moneyed institution dare touch it. Now let us see how this operates; all men who deal in these stocks are more or less of a gambling disposition; they put in a little money and want to make a great deal; they almost always go beyond their means; they buy a certain number of shares, carry them to their broker, or to the Bank of California, borrow as much money as they can get loaned on them, in order to enable them to buy more, and are compelled to transfer their shares—not to the bank, for that would make it responsible for any debts which might be contracted by the mining companies, but to one of their irresponsible clerks, A. E. Hill, for instance, whose name figures quite extensively in the delinquent lists, and whose name only stands for that of so many miners or other individuals. Thus that bank clerk has a large amount of stock standing in his name, without owning a share, and no outsider knows whose stock it is. This is one way the bank obtains control of a large amount of stock both at San Francisco and at Virginia; but by far the greatest part comes under their control in a still easier way. Most of you miners and others who speculate in stocks go to a broker, deposit your money and get him to telegraph to his partner in San Francisco for a given number of shares in a certain mine; the purchaser here never sees that stock; it is issued in the name of the broker, for to issue it in the name of the purchaser causes delay, inconvenience, and expense. Many of these brokers receive accommodations from the bank, and are consequently under obligations to them; many others are simply convenient stool-pigeons in the hands of the bank ring. Now what is the result of all this? When the annual election comes off in a mining company the managers of the bank hold a sufficient amount of stock in their hands as collaterals, together with the proxies they obtain from brokers, who represent the miners and others, so that they can almost invariably step in to an election and cast this vote for a set of trustees which have previously been made up in the back office of the California Bank. And who are these trustees? About a dozen of them compose the trustees in nearly all the mining companies, and a majority in each company are either under the thumb of or mere tools of the bank, and if you were to examine the books you would find that most of them do not own more than three or four shares apiece. And these few miserable shares even do they not in many instances own at all, but they are simply loaned them, and transferred to their names so they may act as trustees. Those are the men whom you allow to manage your property. In order to throw sand into people's eyes, one or two trustees are usually elected who bear a high reputation for integrity; and so adroitly are the affairs of most of these companies managed between the majority of the trustees, the president of the company and the superintendent, that the minority of the board often do not suspect even that anything is wrong, and thus lend their names to the most nefarious schemes for entrapping the public.

In some instances the bank ring cannot obtain sufficient stock in the manner indicated, and then they are compelled, although reluctantly, to purchase a sufficient amount temporarily to make up a majority until after the election. To show how much value is placed in getting the management of a mine, considering that the trustees receive no salary, you need only look back to the election of the Hale & Norcross a little over a year ago, when the bank ring paid as high as \$16,000 per foot, while the true value of the stock was less than \$2,000.

In this manner the ring, without owning a share of stock, or but very little, obtain the management of these mines and become your masters, while you are, to a large extent, the owners of the property. They become the absolute tyrants who rule over you, and threaten to discharge you if you do not dance according to the tune they fiddle. They arrogate to themselves the power and dictate to you, the proprietors of these mines, what shall be done; they regulate the amount of your wages; employ and discharge you as they see fit, and even threaten to turn you all out and employ Chinese in your stead. Of course, they lose no opportunity and embrace every occasion to impress you with the pretended fact that they own a very large amount of stock in all these mines. Go and examine the books, convince yourselves, and then wonder how such unblushing falsehood, based on brass and impudence, could have existed so long and not be exposed.

Now let us see how their control of the mines further operates: there is a concern called the Union Mill and Mining Company, supposed to be composed of just about the same men as control the California Bank and the mining companies. At the head of that concern, at Virginia City, is the agent of the California Bank. Somehow or other this mill association has gobbled up all the valuable mills in the neighborhood, and, as is stated, by paying but a very small portion of the cost of them. Most of

these mills were erected by private individuals, depending on a supply of ore from the companies on the Comstock lode. As indicated above, the bank ring obtained control of nearly all the mines; it was, therefore, an easy matter for them to furnish such mills only with rock as they saw fit. In this manner some mills, especially those whose financial affairs were not very sound, could get no supply of ore. In trying to keep running on small supplies from outside mines, and here and there on temporary supplies from the Comstock lode, which was furnished them in order to varnish over the manipulation then progressing, their mills would stand idle a portion of the time, which involved them into debt. They had to borrow money from the California Bank, the only moneyed institution at Virginia City, which had a policy of being remarkably accommodating in such instances. The poor victim taking that money signed his death warrant. As soon as he became thus indebted he could somehow or the other obtain no more ore for his mill at all; he could not pay the interest on his indebtedness; and after a few months the mortgage on his property costing, say \$100,000, would be foreclosed for about \$20,000, utterly ruining him.

In this wise the mill ring or bank became possessed of nearly all the valuable mills in the neighborhood, costing millions of dollars, at a comparatively trifling cost to them.

Now, mark the result. The same ring is managing the bank, the mills, and the mines, but own but precious little interest in the latter. Of course they are sure to make all the money out of the mills, even at the expense of the mines. Mills with a capacity of 1,000 tons per day must be kept supplied at all hazards. The price of crushing is fixed at \$13 per ton, by the mutual agreement of the same crowd; this leaves a profit of \$7 per ton, or \$7,000 per day. If a mine does not furnish rich ore, poor is sent to the mills, for they must be kept going. If that runs the mine in debt, how easy is it to put on an assessment, and make you, the stockholders, pay the loss, or, in other words, turn over the amount thus collected into the pockets of the mill association. If a mine has some rich ore, but only a limited quantity, how easy is it to internix a sufficient quantity of bed-rock in order to increase the number of tons to be worked. It is asserted, and can be substantiated by many credible witnesses, that thousands of tons of ore have gone to the mills which paid as low as \$5 per ton, while it costs \$20 per ton to mill and mine it, thus taking \$15,000 out of your pockets for every 1,000 tons worked; that is to say, in twenty-four hours.

But this is not all. There is still another way by which you are victimized. Supposing the superintendent and foreman of a mine are pliable tools in the hands of these cormorants, how easy is it when a rich body of ore is discovered to keep it secret, and instead of taking it out start the miners going in a wrong direction, taking out inferior ore or bed-rock, sending it to the mills, involving the mine in debt, necessitating assessments, and thus depreciating the stock. And how simple is it for the ring to gobble it all up again quietly while it is down, and after a large amount of it is secured to set all the men to work that can find room and take out the good ore, make a great noise over it, declare large dividends, send up the stock, and then quietly step out and pocket a million or so.

How many of you have been bitten in this manner? What show have you when the cards are stocked on you? Have you ever seen a cat play with a mouse? It lets it run a little piece and then catches it again, and repeats the experiment a number of times, to its great delight and amusement; but did you ever know it to fail that the cat ate up the mouse in the long run?

A few of you make a good strike once in a while by sheer accident; that keeps up the excitement, and so you keep all gambling in stocks, pay your assessments, and in the end you will all be eaten up like the poor mouse. There is no guess-work about it; it is a sure thing.

There is still another item connected with these mines which is worth while looking after. The parties managing them of course have control of the funds of these concerns, and the handling of a million of dollars or more, year in and year out, is an item not to be despised. If the ring is hard up, as the case is now, why it is an easy matter to slap on an assessment of a quarter of a million or so, and thus make the people come to the rescue of their empty cash-box.

These great financiers who have undertaken to regulate the money affairs of this coast, with all their scheming, and notwithstanding the immense sums they have filched out of the people, have arrived at a point where bankruptcy stares them in the face. The California Bank, with a capital of \$5,000,000 and a surplus of \$2,000,000, cannot loan out a dollar to any one at the present time. What have they done with all this money? Where is it? If they are solvent why can't they accommodate the public now when it is most needed? They have kept out greenbacks in order to prevent eastern capital from coming here, and now reap the fruits of their folly. While they have ruined themselves, they have brought untold hardships unto this people in the present crisis. Their last bearing operation has recoiled upon themselves; stocks and all property have gone down beyond their control, for they did not have the sagacity to foresee that the bubble which had been growing for the last six years, in anticipation

of the Pacific Railroad being finished, would burst in the act of driving the last spike. They fondly hoped that eastern people would flock out here with full money-bags and invest at the inflated prices. They did come, and saw at a glance the game which was put up for them, and declared they would come back in another year and invest at twenty cents on the dollar, when they were all broke out here. So much for their financial capacity.

But the ring, not yet satisfied with all these manipulations, and with an unsatiated desire to draw the very last drop of life-blood from the people, has lately entered into another scheme of pilfer. I refer to the Virginia and Truckee Railroad. Not satisfied with controlling the mines; not satisfied with owning the mills; not satisfied with all the plunder obtained before, they came to the conclusion that a railroad to the Carson River, where their mills are mostly located, would be a good thing. They not only thought that by owning such a road they could drive all the teamsters out of the country, and thus squeeze two or three dollars' additional out of every ton of ore transported over their road, but they also expected to monopolize all the wood and timber trade, and charge whatever price they please to the mining companies. But while they were accomplishing all this, and opening up a new source for plunder, their great motive for getting up this railroad scheme was that they expected thereby to kill the tunnel project, at least for some time to come. Of course they could not pretend that a railroad to Carson River would drain or ventilate the mines, or abolish the steam-engines, or explore the whole country, but they did falsely pretend that all the low-grade ores could be extracted, and with the increased facilities for transportation, reduced to advantage. If they did not expect to make people altogether believe that the railroad would be a substitute for the tunnel, they did at least expect that this threatening tunnel question would be postponed thereby for another year or two, with so much additional chance of seeing me used up by that time.

But to build a railroad costs money; and being accustomed to obtain whatever their heart desires from the people, they concluded to own a railroad and have the dear people pay for it.

Being the trustees of the mining companies, it was an easy matter to subscribe to themselves such amounts as the stockholders would possibly stand—some of the mines levying assessments in order to raise the money. Thus, about \$500,000 were contributed, for which the trustees, before long, will be held responsible, as an act on their part entirely unwarranted and illegal. But this amount was not sufficient to build the road, so it was concluded to get the legislature to come to the rescue. Bills were passed—God only knows how—and Storey, Ormsby, and Lyon Counties were compelled to give and make a present to the ring of bonds amounting to \$575,000. The people were misled, in the first instance, by the false title of the Virginia and Truckee Railroad, and in their anxiety to obtain a connection with the Central Pacific, which lies north of Virginia City, they overlooked that the bill passed by the legislature was for a road to Carson River, in the opposite direction. Was there ever such a swindle perpetrated before on any people? Every man and woman in these three counties compelled to contribute their hard earnings to meet the interest and principal, amounting to over a million of dollars, and which will ultimately swallow up all your private property, for bonds issued to a railroad which will not be one particle of benefit to the people, but only to a clique of men, the self-constituted rulers of the people. But whom the gods wish to destroy, they first make mad. That railroad business was too much for the people; it has opened their eyes, and the remedy will be found; they will assert their rights and throw off the yoke of their oppressors.

Steps should immediately be taken to prevent the issuance of these bonds; the law is clearly unconstitutional, and no court in this State will dare to sustain it. If the legislature had the right to compel you to give away \$300,000, why, they would have the same right to compel you to give \$3,000,000; they would have the same right to take all you possess. The thing is too absurd to require any argument. Stop the payment of these bonds, and you compel the ring to finish the railroad from their own means, if they have any; then start the tunnel going and you will break them up altogether, for they will not be able to sell out their railroad stock, as they expected to do by next spring, by running immense quantities of low-grade ores down to the mills, and thus make a big showing as to the profits of the road; in making that showing they expected you to foot the bills, by paying assessments to make up the loss sustained in working the rock, which must run the mines in debt.

Fellow-citizens, do you commence to understand why this ring oppose the construction of the tunnel? They have thus far had things their own way and have with a high hand grasped and taken everything worth having in the State of Nevada; they, like the devil-fish, have reached out their long, slimy arms and taken hold of everything within reach, and nothing can escape its deadly grip. Do you think for a moment that they would allow so valuable a property as that of the Sutro Tunnel Company to escape their notice? Do you suppose that this clique, whose ideas of mine and thine are very confused, would not go to every exertion to obtain so great a prize by intrigue, machinations, and scheming? Do you suppose they would allow a supe-

rior power to spring up in their very stronghold, and not make every effort to destroy it? And do you believe that they would allow it to grow at all, but that they would nip it in the very bud?

The tunnel, they know full well, is the key to this mountain and these mines, and will and must control and own this whole district; if that tunnel is constructed by third parties, their monopoly will be utterly broken up and ended. They could then no longer bull and bear stock, manipulate the mines and mills, and their railroad would be of but little use.

Now, what course have they pursued to defeat the construction of the tunnel? Have they opposed it openly? By no means. They considered that the projector, with limited means, not being able to cope long against so gigantic a monopoly, would soon succumb, and, worried and defeated, would be compelled to turn over his valuable franchises and property into their hands, together with the chances for an appropriation from Congress, which they expected to obtain through their political friends without much trouble.

They have, however, this time been mistaken; they expected me to give up in disgust in less than six months after their relentless warfare commenced, and I have successfully stood up against that overwhelming power for several years, and have not been quite crushed out yet.

Will the people of Nevada see me crushed out now? Will they allow that monstrous combination to trample me under their feet? Will a chivalrous people allow one individual to be set upon by a whole pack of hounds? Will you see fair play when one man has the pluck to stand up against a crowd? Will you come to the rescue when I appeal to you, in my endeavors to carry out a great and good work? I believe I need not make the appeal, for I know you will.

Laboring men of Nevada, shake off the yoke of slavery and assert your manhood. The same power which has thus far defeated the tunnel project is crushing you down into the dust; they threaten to take your bread and butter from you if you subscribe to the tunnel stock; but you must act jointly, and there lies your power. If you will all come in together, they dare not discharge you; let three thousand laboring men pay in an average of \$10 per month, which gives you \$30,000 per month, or \$360,000 per annum, and insures the construction of the tunnel, carrying with it the control of the mines. That amounts to 33 cents per day. Who is there among you so poor as to miss it? How many of you expend that much every day in stimulants, cigars, and other luxuries? Put that money into the tunnel; it is laying up something for a rainy day. The money will be expended directly again in labor among yourselves *under your own direction*, and from dependents you will become masters. It will be the most glorious triumph of labor over capital. It would be realizing the wildest dreams of the French socialists, Proudhon, Le Blanc, and others, who have in vain tried in Europe to bring about just such results. The masses there do not possess the intelligence you do, nor was there ever such a chance offered to the people. Show your superiority here and act promptly. Set an example to the world, demonstrating what can be done by joint action. Do not listen to your enemies. They have vile, miserable runners among you who will try to poison your minds; they will try every means in their power to prevent you from entering into so magnificent a project, which will make you masters of the situation and leave your opponents out in the cold. They will argue with you and declare it not feasible; they will pronounce the whole scheme chimerical; they will tell you that you are wasting your money and that it will be misapplied; they will say to you that the whole thing is a swindle.

Workingmen of Nevada, men who talk to you in that way are hired by the Bank of California. They are traitors in your ranks. They are your base enemies, who have sold their honor and want to sell yours for so many dollars and cents. There may be some among you who do not fully understand the results which will flow from the work; let the most intelligent ones make it their duty to enlighten them.

Laboring men of Nevada, crush out that hydra-headed monster, that serpent in your midst—the Bank of California. By forming this great co-operative association labor and capital will be linked together. Your power will be unlimited. No more hiring politicians will be thrust upon you in order to misrepresent your interests; you will be a great political power, and will rule the destinies of this State; everybody will bow down to you; you will be the masters of the land; the newspapers will advocate your cause; and from a state of utter dependency, from a state in which you are fearful from day to day to lose the means of your very subsistence, you will pass over, for the first time, into a true state of independence.

Fellow-citizens, were there a foreign enemy at your doors, who had come to crush out your liberties, break up your government, and with a high hand rule over you, who is there among you who would not sacrifice his life, his fortune, and pledge himself upon his sacred honor to crush out and defeat so vile an enemy? Who is there coward enough to stand back and not defend his home and hearth? None, I dare say.

And still that enemy is in your midst. You allow and have allowed him to exist among you until he has gradually stolen your liberties, robbed you of your fortunes,

and prevented the administration of justice. Trifling were the encroachments committed by England upon her American colonies when they rose up in their might, threw off the yoke, and formed these United States, compared to the indignities which are daily heaped upon you. What has become of justice? What protection have you any longer in the possession of your property? The enemy who has spun his web around you until you are almost helpless, has bribed your judges, packed your juries, hired false witnesses, bought legislatures, elected representatives to defend their iniquity, imposed taxes upon you for their private benefit, outraged common decency, and now dare you to expose or oppose them. Has it come to pass that a free community of this great American nation has degenerated into a set of miserable cowards? I believe not; the enemy has stolen in among you stealthily and gradually; he has enslaved you without your knowledge; he has crept in while you are asleep.

Rouse up, then, fellow-citizens. You have no Andrew Jackson among you to crush out the bank which has taken your liberties, but you have the power within yourselves. I do not mean to incite you to any violence; I do not mean to have you assert your rights by riot, force, and threats. That would be unwise, unnecessary, and would only recoil upon yourselves. But I do mean to say that you can destroy your enemy by simple concert of action. Let all of you join in together to build the Sutro Tunnel; that is the way to reach them. They do already tremble lest you will act; they know you will form a great moneyed power, and that you will own the mines; they know it will cement you together.

They also know full well that the first pick struck into the Sutro Tunnel will be the first pick into their graves; and they also know that the same stroke of that first pick will be the signal for a new era, which will dawn upon the working people of Nevada.

Fellow-citizens, you are poor and cannot squander any money; the vampires have nearly sucked you dry; but the tunnel stock is a good investment; the shares are unassessable forever, so as to protect the poor men; one share is as secure as a thousand. The tunnel company owns a princely domain; thousands of lots will be sold in the new town; we own the most valuable mining grant in the whole world; all the mining companies are compelled to pay tribute, amounting to millions of dollars per annum. In buying a share in the concern you absolutely own it; nobody can ever assess you one cent; you own your share in all the property the company now has or will ever possess; you will own your share in any appropriations the Government will ever make. Some of you will say you are not going to stay long in the country. That makes no difference; it is a good investment, no matter what part of the world you are in; you pay \$5 and get an interest, or a share of \$10 in the company. When the tunnel is once finished, and probably long before, the company's income will be immense; it will probably declare dividends sufficient to pay for your investment every year. A few thousand dollars invested in the tunnel stock now may give you an income to support you the balance of your life; it is not, like most mining enterprises, of a temporary character; it is a work which comprises a whole district; all mines have to pay their *pro rata*; if one mine runs out of ore, another one will make a new strike; and so you may expect a steady income from your investment during your lifetime, and probably that of your children.

The stock is not transferable for the present; that is necessary to keep the bank of California from controlling it; that is necessary for your own security; I would not advise you to invest in it were it otherwise, for it would be beyond my power to see you protected. If the requisite capital is once obtained, and the company incorporates, then the stock will be made transferable; it will then be beyond the power of any moneyed institution on this coast to injure us.

The stock or receipt you get is signed by me as agent for the Sutro Tunnel Company, under special powers derived from all the trustees of the association; besides the title to our land, and mining grants, and other privileges, was made by Congress to me individually, in trust for all concerned, for the purpose of facilitating the transfer of all or any part of our property. Any document, therefore, signed by me will convey to you a full and clear and unincumbered title to the interest you obtain, which can never be assessed.

I am satisfied that three thousand, nay, five thousand men can be found in western Nevada to save up ten dollars per month for investment in the tunnel; then you have the eastern part of this State and the State of California. You have the whole Pacific coast, and, if necessary, the Atlantic States, to come to your assistance.

But one waits for another to see whether a sufficient number will come in. That will not do; you will never accomplish anything in that manner.

It is true, nobody proposes to enter into bonds. If old Comstock had waited for somebody to sign bonds before he put his pick into the ground, he would be waiting yet. If you refuse to educate and clothe the boy until you see whether he is going to grow up, he will not be fit for much when he is a man. If you do not prospect a mine until you have made a fortune out of it; if you will not go into the water until you learn to swim; if you will not take the first step until you are within sight of the end of your journey, this life would be a very short horse and soon carried. Fancy the

tunnel done, a glorious fact, and see how small all such objections will look. If there is a motive to begin the tunnel, how much greater is it to finish it. The whole secret lies in starting it going. Get the sharp end of your wedge fairly inserted, then drive away, and every blow will tell.

Come forward, then, and subscribe your names; pay in your money promptly. If you can spare but \$5 this month, go up to the office and put it in. Some of you will put in \$100. We have sufficient money in the treasury now to commence work within a few days. Come at once, then, and you will prove your friendship for the cause.

If my individual efforts have been sufficient to induce many of you to come in, how much greater will be our influence and strength when several hundreds, or even thousands, are interested. How much greater will be our influence at Washington, and how much greater the chance of obtaining the subsidy asked for.

Do you have any fear the work will ever stop again after it once starts? I have none myself. When that tunnel is daily progressing, with chances of striking rich veins at any hour, everybody will want to invest; everybody will then be the friend of the enterprise. When people see it is going to go, they will all say they knew it would. You will no longer be able to find any one who ever opposed it; the newspapers will all come out for it; the excitement will run high, and in a very short time people will be eager to invest at double or triple the price.

So much, then, for the dollars and cents view of the question; but let me revert once more to the other, which is by far the most important.

Supposing, then, your contributions were outright gifts to the cause, would you be the loser? I think not.

Miners and laboring men, what is the price of your health, your liberty, your independence? Are they not worth more than all the filthy lucre you could possess? Who is there among you so avaricious as to refuse to give and donate outright a few paltry dollars per month to a cause which will elevate your race, secure your health, your liberty, and your independence? A cause which will insure to you liberal wages; a cause which will effectually settle that vexed Chinese question; a cause which will make you the power of this land, make powerless your oppressors, and break up your arch enemy, the California Bank. I say, who is there so blind as not to see the magnitude of the question?

Let a noble rivalry spring up among you who shall come in first; drop all prejudice; let all trifling objections fall to the ground; let one excel the other in magnanimity; let all make one joint, grand, unanimous effort, and victory will be ours.

SUTRO TUNNEL,

HEARING BY

THE

COMMITTEE ON MINES AND MINING,

OF THE

HOUSE OF REPRESENTATIVES.

MONDAY, FEBRUARY 12, 1872.

Mr. SUTRO. Mr. Chairman, I would like to ask General Foster, who is one of the commissioners appointed by the President under the act of Congress, approved April 4, 1871, to examine and report upon the Sutro tunnel, a few questions with relation to certain facts in that connection. I find here, General, on page 8 of the report, you state as follows:

"Under the present system of operating the mines"—

Mr. NEGLEY. Please state what was the composition of the commission.

Gen. FOSTER. There is General H. G. Wright, Lieutenant Colonel of Engineers, Brevet Major General United States Army; General J. G. Foster, Lieutenant Colonel of Engineers, and Brevet Major General United States Army; and Wesley Newcomb, Civil and Mining Engineer.

Mr. SUTRO. I was reading from page 8, as follows:

"Under the present system of operating the mines, the ore and the refuse rock are raised to the surface, through the shafts, by steam power; the ore being transported to the mills by wagons, or by the railroad before alluded to, and the refuse rock deposited at the dumps contiguous to the shafts. The items of expense, as given by the superintendents, vary somewhat, as might have been expected, in view of the different circumstances in each. The average of certain of the more important of them may, however, be stated with sufficient accuracy, as follows:

"Cost per ton of hoisting from depths varying from 1,200 to 1,750 feet, being the average reported for seven of the principal mines of the lode, \$0.51.17.

"Cost of pumping for the year ending June 30, 1871, as arrived at by the commission, by taking the cost of the mines as far as reported, and estimating for the rest \$124,674."

—Now, I want to ask you, General Foster, how you arrived at these figures: whether you simply took the statements of the superintendents of the companies, or whether you had an opportunity of examining the books of the companies as to the correctness of those statements?

A. It was decided by the commission to address to each of the superintendents of the mines an official communication, so that their replies to certain questions, which were presented in that official communication, should be official, and signed officially by the superintendents, thereby furnishing us material upon which we could base our report, and which we could annex to our report. We did not seek access to the books, because we wanted specific information on certain points, which they could furnish better, if we addressed them in this way. Their answers were received, and they are incorporated in the appendix to the report. We based our estimates upon those statements. We had no more reason to doubt the accuracy of those statements than we had to doubt the accuracy of their annual reports. My answer to your question, therefore, is, that we based our estimates upon the statements they made in reply to our inquiries—upon their official statements.

Q. Have you made any comparison between the statements which were made by the superintendents and the statements furnished by their annual reports? Have you been able to make a comparison, or has it been possible for you to make one, as far as the accuracy of these statements is concerned?

A. Well, we made certain comparisons; but with us it was not a question of invalidating their reports. We did not make comparisons with a view to test the complete accuracy of what they wrote us. As the basis of estimates, we had no reason to question the veracity of their statements, and we took their statements.

Q. Exactly. Now let us turn to page 9.

Mr. KENDALL. By the way, Mr. Sutro, you refer to the annual reports of the superintendents of the mines, do you not?

Mr. SUTRO. Yes, sir; to their published reports.

Mr. FOSTER. We compared all the statements we received with their annual reports for the year ending July, 1871.

Mr. SUTRO. Last year?

Mr. FOSTER. Yes, sir; we had those reports. We had also some of the previous year. We had also the general table that is published, I believe, every three months, giving the amount of assessments, the amount of dividends, etc. We compared their statements with all those. We had not, however, a complete set of their official reports.

Mr. SUTRO. Are those annual reports of the mining companies given in such a manner that you could arrive at any estimate of the cost of hoisting, for instance? Are they given in detail?

A. I don't think they are, in the form in which they are given to the public. It is not designed to go into these points in their annual reports.

Q. They don't give a complete copy of their books, in fact. Now, if we turn over to page 9, you will find an estimate you made of the cost of working, as it is done at the present time. You state that—

"If we assume what appears from the reports and from other sources as an average yield of the mines, viz: 365,600 tons annually—the cost for certain items of expense by the present method of working will be as follows:

"Hoisting 365,600 tons of pay ore, at 51.17 cents.....	\$187,077 52
"Transportation of same to mills, at \$1.50.....	548,400 00
"Pumping for last year, (commission's estimate).....	124,674 00
"Hoisting and lowering 3,000 miners, at 8 cents each way, or 16 cents each.....	175,000 00"

That makes a total cost of \$1,035,151.52.

Now, I want to ask you whether this estimate of \$187,077.52 for hoisting is taken as an average of the statements by the superintendents?

A. It is, for hoisting that distance—from 1,250 to 1,700 feet.

Q. You have taken their figures and made an average of them?

A. Yes, sir; the statements are all printed in the appendix to this report.

Q. Pumping for last year you estimate at \$124,674. Did you arrive at that estimate in the same manner?

A. Yes, sir; in the same manner.

Q. I believe you state so on page 8,

"By reference to the statements of the superintendents, appended to this report, it will be seen that the cost of pumping for all the mines did not, probably, exceed \$150,000 for the past year, and that in some of them there was no water at all. This sum exceeds that arrived at by the commission, viz, \$124,674, which was obtained by taking the costs as given for the mines so far as reported, and estimating for the others."

That is the language?

A. Yes, sir.

Q. When you speak of "estimating for the others," do you mean you based your estimates upon the information furnished by those seven superintendents?

A. Yes, sir; partly on that. In making the estimates, however, we relied somewhat upon our observation—the information we derived in our visits to the mines.

Q. Now, if we turn over to some of these statements about cost, as furnished by the superintendents, we find on page 29, at the bottom,

"Total cost per day for hoisting two hundred and sixteen tons of ore 1,750 feet, \$63 95, or 29.6 cents per ton?"

A. Yes, sir.

Q. That is the statement made by Captain H. H. Day, the superintendent of the Ophir Silver Mining Company?

A. Yes.

Q. He speaks of hoisting two hundred and sixteen tons of ore; were they hoisting any ore from the Ophir mine when you were over there?

A. No, sir; they were hoisting refuse rock.

Q. Yes, those are simply nominal figures. They are not based upon any fact at all. That 29.6 cents per ton is an estimate, made out—

A. Well, it costs the same to hoist rock as it does ore, and the circumstances are substantially the same.

Q. Well, now, Mr. Day, on page 28, gives us an estimate how much it costs the Ophir mine. He shows here that the labor of miners, of carmen, of blacksmiths and helpers, of engineers and firemen, of wood hauling and powder, fuse and caps, steel, candles, wood, everything put together, in fact, the total of mining, cost \$64.04 $\frac{5}{10}$ a foot; that is, in sinking the shaft of the Ophir mine from the 720-foot level, (there is a misprint here; it reads 270 feet; it ought to be 720,) it has cost \$64.04 $\frac{5}{10}$ a foot. Then he goes on to state, furthermore, that it costs \$10.27 to timber the same, which gives a total of \$74.31 $\frac{5}{10}$ for every foot of descent of the shaft. The next statement is in regard to the cost of making the drifts in the mine. The superintendent of the Ophir mine proceeds to show here how much it costs to make the drifts in the mine; namely \$25.11 per foot. The Ophir company had sunk their shaft the depth given here, 1,002 feet. Was that the depth they had reached the time you were there?

A. Yes, sir.

Q. Well, they have extended their shaft somewhat in depth since; and on the 5th of February, the present month, they had reached a depth of 1,270 feet. That is the Ophir shaft. During the time they were occupied in constructing that shaft, they made drifts amounting to 3,350 feet. According to the statement which Captain Day furnishes here, we get \$74 31 for every foot of descent.

If we multiply that by 1,270, the number of feet of depth, we get----- \$94,373 70

If we multiply 3,350 feet of drift by \$25 11, the estimate furnished by Captain Day, we get-- 84,118 50

Or a total for both of-----\$178,492 20

Now, let us see how much the Ophir company has spent. We have here the official reports made by Mr. Raymond, the United States commissioner on mining. He states in his report for 1868 (that is the official report published by

order of Congress) that the Ophir company, (the report is dated December 18, 1868,) had levied assessments up to that time amounting to \$593,000. The old mine and shaft were abandoned about sixteen months before. That was on the 18th of December, 1868. He states,

"The old mine and shaft were abandoned about sixteen months ago, since which time work has been progressing on the new shaft, without however ever striking any ore."

And consequently we find that the Ophir company, since that time—sixteen months previous to this date, which brings us back to the 18th of August, 1867—has done nothing but sink a shaft and make certain drifts from that shaft without striking any ore. You are aware that there has been no ore found in the mine?

A. Yes.

Q. That you know of your own observation. What I want to show now is the amount of money this company has collected, and compare that with the statements furnished in the reports to the commissioners. It is stated here that the assessments which have been levied up to that time are \$593,000. We find that since 1867 they have levied the following:

They levied in the year 1867, in the latter half-----	\$100,000
King's report, (page 169,) which is also an official report, shows for 1867-----	184,000
From which deduct assessments levied in the first half of the year-----	84,000
And you have for 1867-----	\$100,000 00
We find in Raymond's report for 1868 the assessments for that year were-----	168,000 00
For 1869, Mr. Raymond states it at-----	134,000 00
In 1870 it is-----	168,000 00
And the expenses stated by Captain Day, for the year 1870, are-----	140,571 87
This makes a total of-----	\$710,571 00

collected by the Ophir company since they commenced this new shaft. There were, however, other items which they collected from the sale of machinery and mills, which amount to some seventy-odd thousand dollars. The amount was \$66,663, which they received from these other sources. This makes a showing that they have collected, as above, nearly \$800,000, as taken from the reports of Mr. Raymond.

But if we take another basis, and take Wheeler's report, published on the 15th of November, 1871; we find that the total assessments of the Ophir company were \$1,144,000 since its incorporation; and that is an official report. It is taken as authority by all. It is the official mining report. If you deduct from that amount \$593,000, which is given here up to the 18th of December, 1868, by Mr. Raymond, we get \$551,000. With what had been levied in the year and a half previous to that, we get \$819,000, very nearly corresponding with the figures I have given. Now, for that \$819,000 the Ophir company has constructed 1,270 feet of shaft and 3,350 feet of drifts, which have cost, according to the statement given in the report of the commissioners, \$178,492 20. The work has cost \$178,492 20, and the company has collected \$800,000. There's a discrepancy of over \$600,000 here. The present superintendent of the Ophir mine, (Mr. Day, who was superintendent there before, having been discharged,) will furnish any data that may be wanted from his books. I took the trouble to telegraph him to find out precisely how many feet they had constructed at their shaft, and how many in drifts. Here is my telegram, dated February 4, 1872:

"To PHILIP DEIDESHEIMER, *Virginia City*:

"Telegraph total expenditures of Ophir company since new shaft started; also how many feet drifts and shaft constructed since that time."

That is my telegram. Here is the answer, dated February 5:

"Main shaft down 1,270 feet; winzes, 400 feet; drifts, 2,950 feet; shaft expense is \$423,000; machinery expense is \$173,000; total expense of Ophir new shaft, \$596,000."

Five hundred and ninety-six thousand dollars! This

don't quite come up to the figures which we arrive at by taking the assessments levied, but still it amounts to a very large sum—to about \$600,000. Now, if we go a little further into these figures—

Mr. WALDRON. One moment, Mr. Sutro. This machinery expense of \$173,000 of course is not included in this statement of Captain Day.

Mr. SUTRO. No, sir. We don't include that. We take the expense of \$423,000, the actual expense at the shaft.

Mr. WALDRON. The fair comparison is between the \$423,000 and the amount that this would figure up at \$74 a foot.

Mr. SUTRO. Precisely. In the commissioner's report this figure is given.

Mr. KENDALL. Have you calculated what would be the expense per running foot of all this shafting and drifting, to show the difference between your estimates and those of the commissioners per foot?

Mr. SUTRO. The difference is just $2\frac{36}{100}$ times as much. That is the exact figure. Taking \$173,492 as the cost given by this estimate furnished to the commissioners, while the actual cost has been \$423,000, we have to multiply all these sums, these data, by $2\frac{36}{100}$, in order to arrive at the correct cost. I want to show now, if we examine a little further into these figures, that we find it stated by Mr. Day that the dimensions of his shaft (it is on page 28) are, outside of timbers, 18 feet 8 inches by 7 feet 4 inches. The dimensions of his drift are 4 feet 7 inches by 6 feet 6 inches. So that, by calculating the area, we get the cubic contents of each foot of descent in the shaft, viz, $10\frac{52}{100}$ tons, taking 13 cubic feet of rock for a ton. Here we have for every foot of descent 10 tons and $\frac{52}{100}$ of a ton. 1,270 feet of shaft in descent will give us 13,360 tons and $\frac{41}{100}$. Taking the drifts, we find 3,350 feet, which would average, according to his figures, 2 tons and $\frac{25}{100}$ per foot; that is, every foot of drift gives us $2\frac{25}{100}$ tons. This gives us a total of $7,537\frac{50}{100}$ tons, extracted by the Ophir company, of waste rock from the drifts, and $13,360\frac{41}{100}$ tons taken

out from the shaft, a total of 20,897 $\frac{91}{100}$ tons taken out since the new shaft was started, and that event was on the 18th of August, 1867. If we take that as a basis, 20,897 tons, which is absolutely the total of tons extracted from that mine, during which time the actual expenses have been \$423,000, we find that during 1,628 days, or four years, five months, and eighteen days, they have hoisted out 12 $\frac{84}{100}$ tons per day. According to the statement which Captain Day furnishes, of 29.6 cents per ton for hoisting, we have a daily expense of hoisting rock of \$3 80. Now, do you believe that is correct, General Foster, that the expenses of hoisting rock from the Ophir mine are only \$3 80 per day?

Mr. FOSTER. Well, I am not prepared to state, because I have not followed your calculations; but we went to the Ophir mine and examined it pretty thoroughly, and made notes there. We took this statement and the items of hoisting rock and ore. The first items of hoisting would be the engineers' and firemen's wages, the wood hauling, fuel, oil, tallow, etc., etc., and the interest on the machinery, the wear and tear. These are some of the small items. We took his estimate and went over it, and made up our minds that it was a pretty fair estimate, taking the prices as they were out there. He gave us sufficient confidence in the estimate to base our estimates upon it.

Q. But upon how many tons was this estimate based? Did you know or did you arrive at these figures, showing that the average hoisting was but 12 $\frac{84}{100}$ tons per day? His estimate is upon the basis of taking out 216 tons per day, but they never took that out.

A. Well, we know that they can run the cars at the rate of 800 feet per minute; we know that they carry double-deck cars, because we saw them doing it; we know that each car contains about fifteen hundred pounds; we know that they can run easily six trips an hour, including all the stoppages, delays, etc., and hoisting the men; and taking these six an hour, and twenty four hours in the day, you will get just 216 tons.

- Q. Yes; but that has not been the amount extracted.
- A. I don't say that they hoisted 216 tons; but if they run their machinery the way they can run it, paying their engineers, firemen, wood-haulers, etc., according to the prices out there, running the machinery all the time regularly, they can hoist 216 tons a day.
- Q. But that is not the question I want to get at. I want to get at this question: Do you believe that 12 $\frac{84}{100}$ tons per day can be hoisted as cheaply per ton as 216 tons?
- A. No, sir; it cannot.
- Q. Do you believe it possible that they could even oil that whole machinery of hoisting for \$3.80 a day?
- A. No, sir; not if they run it all the time.
- Q. But could they run it at all at that rate?
- A. No, sir; they could not start the machinery for that. Each fireman's wages would be \$4.00.
- Q. Well, now, in making your estimates about the cost of hoisting, you have taken the statements which these gentlemen have furnished. As I have shown already, the cost of hoisting here is based upon a very large extraction; and this gentleman at the Ophir mine, where they have taken out no ore at all, bases his figures upon an extraction of 216 tons a day, while they only extracted 12 tons a day. Now, in making your figures, taking the average of the statements made by the various superintendents, you arrived at the estimate of 51 $\frac{17}{100}$ cents per ton. If you take the hoisting of the Ophir mine as a basis, you find that the difference in the statement furnished there and the statement of the actual expenses is \$11.70 per ton on every ton of ore: that is the difference we get. Now, General Foster, would you consider that a fair average, taking the statements made by the superintendents, 51 cents a ton, including in your premises the waste rock which has been hoisted?
- A. Well, the waste rock costs exactly as much as the ore, and the statements of all the superintendents as to what it costs them to hoist a ton are given. We took an average of all those statements. Yes, I consider that fair;

because when I went through the mines I asked some of the superintendents, incidentally, what it cost them to raise a ton of ore, and they told me, and I made a note of it at the time. Those incidental reports were made without any idea of their being used, and they accord very well. The general statement was fifty cents a ton.

Q. You took the statements which they furnished?

A. Yes, sir; I took the statements which they furnished and authenticated them by observation.

Q. You state on page 9,

"In the above statement the cost of hoisting the refuse rock from the drifts, winzes, etc., is not included"——

A. Not included; no.

Q.

——"as the quantity is wholly indeterminate, being the greatest in those mines where prospecting alone is being carried on, and the least in those which are working upon ore bonanzas. Indeed, in the latter the amount of debris is inconsiderable. It would be of the highest importance to a full and accurate comparison of the cost of working in the mines by the present method and by the tunnel to introduce this item, as it is very considerable, and the expenditure per ton for hoisting it is the same as for ore; but this seems quite impossible, owing to the indefiniteness of the quantity of refuse from the mines."

You state here that you have not included the hoisting of refuse matter, because you could get no figures, you could get no estimate. Now, what I want to get at is, can they hoist refuse rock from a mine, where it must be very limited, at the same rate that they can hoist a large quantity of ore?

A. Of course they can hoist no more rock than they excavate from the drifts and the shafts; whereas where they are taking out ore they hoist a much larger quantity, because the miners are throwing out a much larger quantity.

Q. Then it costs them comparatively less to hoist large quantities than small quantities per ton?

A. Yes, sir; very much less.

Q. Does it make a material difference in the cost where you have a steam engine or two steam engines, and have got to have engineers and firemen and everything to keep the machinery going, whether you hoist twelve tons or two hundred tons a day? It is nearly the same expense, is it not?

A. Well, no. If you only have twelve tons to hoist, you run your machinery only a short time. If you are hoisting large quantities, you run night and day. In one case you have three relays of men; in the other you have only one.

Q. Well, if you are running day and night in the mine, won't you have to keep your machinery in motion all the time, and hoist out when the time comes?

A. No, sir; I think they can accumulate the surplus in the shaft, and hoist it all at one time. When I was at the Ophir they were not running machinery. They had been running it, but they were not running it then. We went there another time when they were running it. So that they accumulate their rock, I think, down below, on a level, and hoist it up all at one time. I am not sure of that, however, but such is my impression.

Q. But in sinking a shaft, they must remove the rock as fast as it is taken out?

A. In sinking a shaft; yes, sir. But it is not necessary. They can put it up on a shelf.

Q. But in running a drift the rock is removed from the face where they are working, and put into cars at once?

A. Into cars; yes, sir.

Q. But where will they leave those cars if they do not hoist them at once?

A. Well, they can put them along the drift, and have a dozen or twenty cars ready when the time comes for hoisting.

Q. Do you know a single place in the Comstock lode where they don't hoist out the rock as they go along; do you know of any mine, of your own knowledge, where this is not the course pursued?

A. It is my impression that they usually hoist the rock as fast as they mine it, but I do not consider it a necessity at all. As I told you, one time I went to the Ophir mine and they were not hoisting, although they were working below.

Q. Supposing you were to run your machinery all the time, would it not cost as much to take out twelve tons a day as it would two hundred and sixteen?

A. Yes, sir; it would cost nearly as much to take out a little as a great deal.

Q. Well, then, do you consider this a fair estimate which has been given here, of twenty-nine cents per ton, when, according to the figures which I have given here, based upon the actual amount, we find it costs \$11.70 additional for every ton of rock they have taken out; and do you consider that twenty-nine cents would begin to cover the cost in the Ophir mine of hoisting the rock?

A. Well, I don't know. It might, under certain circumstances.

Q. As the circumstances were there—as they have been there; and would you think twenty-nine cents a ton covered the expenses of hoisting?

A. Well, not while we were there; no, not at that particular time. I don't think it would cover their expenses.

Q. Well, taking this as a basis, have you any idea where the discrepancy of \$200,000 in Captain Day's figures comes from? Have you any idea what that money could have been spent for, if it was not for pumping?

A. Well, I had no data to get at the expenditure of money. They had put up new buildings and new machinery.

Q. That is not included in this; the machinery has cost \$173,000?

A. They bought new dumping-grounds.

Q. That, of course, is not included.

A. Of course I cannot estimate how they spent their money.

Q. They have a total here of over \$800,000 which they have expended there, and it is not accounted for; it is only \$178,000, and what has become of the money?

A. Well, that we don't pretend to find out.

Q. Of course you had no access to their books?

A. We took the items of expenses and looked at them

to see whether they were correct, and whether they had estimated them at a fair rate.

Q. Now, if we turn to page 30, in the report of Captain Day, we find he states,

"The amount of water raised during the year ending May 31, 1871, the monthly average of daily measurements, as follows: In June, 1870, 18 inches; July, 16 inches; August, 11 inches; September, 11 inches; October, 10 inches; November, 10 inches; December, 10 inches. In January, 1871, 9 inches; February, 9 inches; March, 9 inches; April, 8 inches; May, 7 inches. Present flow of water, September 10, 1871, 5 inches. Decrease in amount of water at 700-foot level, from June, 1870, to date, $72\frac{23}{100}$ per cent."

Did you enter the Ophir mine while you were over there?

A. We did.

Q. Did you go into the drift?

A. Yes, sir.

Q. You probably know, then, that the drift extends from the 700-foot level, from which he dates the decrease in water here; in fact, he states on the preceding page that the drift does extend from the 700-foot level.

Mr. FOSTER. I beg your pardon; I did not go down the Ophir shaft. I forgot. I think I did not go down.

Mr. SUTRO. Well, I want to call attention to the fairness of Mr. Day's statement. The water in the Comstock lode—

Mr. BANKS. Two or three gentlemen have just come in since the discussion began. I do not understand what particular proposition is intended.

Mr. WALDRON. Mr. Sutro is attacking the report made by Captain Day, superintendent of the Ophir silver mine, which report is attached to the report of the commissioners, and introducing figures and statistics to show that the report of Captain Day is incorrect, so far as the cost of making shafts and drifts in the mines are concerned.

Mr. BANKS. Is it above the cost, or below the cost?

Mr. WALDRON. Below the cost.

Mr. SUTRO. What I am trying to show is this: In the report of the commissioners, on page 9, it is stated, in a comparison between the cost of mining as it is done now, and the cost of mining through the tunnel, that under the present mode of mining it costs $51\frac{17}{100}$ cents per ton to

hoist. I am trying to show that it costs in some mines more than \$10 per ton to hoist. General Foster has stated that this estimate of 51 $\frac{17}{100}$ cents is arrived at by taking the statements of the various mine superintendents and averaging them. That is it, is it not, General?

Mr. FOSTER. Yes, sir.

Mr. SUTRO. The commissioners had no access to the books over there, and the only figures they could make were by taking the statements of these people and averaging them, and basing their report on the data furnished. I want to show that these people have not told the whole truth, have not told the whole thing, as I have already shown in the case of the Ophir company. In this mine, where the expenditures amounted to from six to eight hundred thousand dollars during the time they had been constructing this shaft, according to the statement of the superintendent, it only cost \$178,000. Consequently there is a discrepancy of from four to six hundred thousand dollars.

Mr. BANKS. It is an under-estimate to that amount.

Mr. SUTRO. It is an underestimate absolutely, and it makes an unfavorable showing as regards the comparative working of the tunnel. It is my endeavor to show that these people here who have made these figures have not told the whole truth; they have withheld certain facts which are highly important to know; and they can only be brought out by having these gentlemen state, of their own knowledge, what they know of the accuracy of these figures, and what we can arrive at by examining the official reports which are made from year to year to Congress by the Commissioner on the mineral resources of the country.

Mr. NEGLEY. Mr. Chairman, right here I would like to ask one question of General Foster.

Mr. WALDRON. Certainly.

Mr. NEGLEY. During your investigations there, Mr. Foster, did you discover any feeling of antagonism among the owners of these properties to the projected tunnel?

Mr. FOSTER. Yes, sir; decidedly.

Q. That feeling was general?

A. Not to obstruct their giving information of all kinds. They came to us and said they courted the fullest investigation; and they facilitated our visits to the mines, came to us with invitations, took us to the mines. We went through almost all the mines. They gave information freely, verbally and in writing; but there was a decided feeling of antagonism, as shown by their published reports. In their conversations they said about the same things you find in their reports, made here and in the appendix. Some of them were quite violently opposed; others less so. Some, whose names appear here, appeared to be rather lukewarm in their opposition. Still, as a general thing, with one or two exceptions, they were opposed to the tunnel. The feeling was against it.

Q. Did they give you their reasons?

A. Yes, sir; they gave reasons about as they are embodied in their reports here. They said that they could hoist by the present arrangement cheaper than they could send their ore out by railroad trains five miles, the hoisting being direct, and with nearly the same velocity. They claimed that stationary machinery was cheaper to use than rolling stock; that time was an element in getting miners in and out, and also in getting lumber in and out. They made other minor points, that they enlarged upon in conversation; but these are the principal ones, and the ones to which we attached most importance.

Q. Another question, General. Presuming the introduction of any more facile mode of removing the rock and ore from the mines, would it not lessen the number of employes that are now engaged in operating the machinery and hoisting apparatus?

A. You mean if the tunnel comes in?

Q. Yes, sir.

A. Well, in my opinion it would almost do away with machinery. That is to say, if they mine up from the tunnel, they can, with very simple arrangements of pulleys and endless chains, let down the ore and carry their tim-

ber and miners up; in fact, hoisting apparatus, if at all necessary, would be of a very light character.

Q. Would that not necessarily invoke the hostility of the employes that are there now, seeing their occupations likely to be gone?

A. Perhaps the engineers, and firemen, and pitmen, and wood-haulers; that would be all. You see the miners would have to be engaged just the same as now. The carpenters that place the timbers would have to be employed just as now. There would be very few engineers but would find employment in the new mills that would be erected at the mouth of the tunnel, so that it would not affect labor.

Q. My inquiry arose from the fact, that miners in our coal mines are almost invariably opposed to any innovation or new custom in the old established rules of mining?

A. Now that you have mentioned that, I will say the miners, as far as I could get information from prominent men, seemed to be in favor of the tunnel. I believe the Miners' Union is in favor of the tunnel.

Q. Did they give you their reasons?

A. No; they had no reason that I knew of. They had their preferences, though.

Mr. SUTRO. General, do you know who are opposed to the tunnel, or at least who are charged with being opposed to it over there by these people you speak of? Who is at the bottom of it?

Mr. FOSTER. If you want a straightforward answer, I would say that the property-owners in Virginia City, those that have money invested in the mills around there, the Bank of California, through its agent, and the railroad company.

Q. May I ask you who the owners of the railroad are, as far as you know: whether it is owned by the Bank of California or its men?

A. I don't know who the owners are.

Q. Well, what did you hear over there? Tell us simply

by hearsay. You cannot have an absolute knowledge, for you haven't seen their books.

A. I haven't the slightest idea who owns that road.

Q. Who has control of it?

A. Mr. Sharon seemed to control it.

Q. The agent of the Bank of California?

A. Yes, sir.

Q. Who owns the majority of the mills over there?

A. On the Carson river?

Q. Yes, sir; and the other mills—the majority of the mills.

A. A very large number of the mills is owned by the Union Mill and Mining Company.

Q. Do you know whether the Bank of California has anything to do with that?

A. Mr. Sharon has a large amount of stock in that, I believe, but I am not positive.

Q. Is he the agent of the Bank of California?

A. I heard so.

Q. Well, then, the opposition to it is by the Bank of California, by the railroad, and by the mills—which means the Bank of California—and by some people who own town lots in Virginia City. Do you know why these people are opposed to it?

A. Well, they say that it will render their property comparatively valueless.

Q. Because the town would move away from there?

A. Yes, sir; because the workmen would have to go to the mouth of the tunnel.

Q. Well, it is about the same sort of opposition that men who own a toll-road would make against a railroad, because it would diminish the value of their property?

MR. SARGENT. How large a town is Virginia City?

MR. FOSTER. I should say it had about 3,000 inhabitants.

MR. SARGENT. Oh, it has a great deal more than that. It is a large mining town, isn't it?

MR. SUTRO. I suppose there are 6,000 people there.

MR. FOSTER. In Virginia City?

Mr. SUTRO. Yes; I suppose there are.

Mr. FOSTER. You mean Gold Hill and everything included, I suppose?

Mr. SUTRO. No, sir.

Mr. SARGENT. The result would be to destroy all the property there. Then, aside from those great values, how about those mills that are used, under present circumstances, upon Carson river? Those are considerable, I suppose. Then this railroad that has been built; that would be useless, would it not?

Mr. FOSTER. That would become comparatively useless.

Q. So that, by running that tunnel in there, all these persons owning these property interests would have them destroyed?

A. Yes, sir.

Q. Do you see anything unnatural, then, in their opposition to the project?

A. No, sir; nothing at all.

Mr. SUTRO. General Foster, don't you think that some day there will be an end to mining at Virginia City, the way they are doing it now?

A. No, sir; not at all. They can go down four thousand feet. I don't know how the heat will be there. We estimate that they cannot go below that, because the heat will be almost too great for them to work.

Q. Don't the expense increase as you go down?

A. Yes, sir.

Q. You state in your report that there are out there very large quantities of low grade ores?

A. Yes, sir; very large.

Q. Do you think they could be worked up to Virginia City and carried on the railroad with advantage?

A. Not at the present prices. It would not pay to take out low grade ores at the present prices.

Mr. SUNDERLAND. Do you mean prices of labor?

A. Yes, sir; prices of labor and milling. It doesn't pay now to take out ore that is not worth \$20 a ton. It costs that to mine and mill it, and anything that yields less than

that (although it may assay much more) won't answer to work. But I hope in time they will hit upon some cheap method of reducing the ores, so that a great deal of these low-grade ores will be worked over.

Mr. SUTRO. Don't you think, General Foster, that if these shafts were connected with the tunnel, it would be cheaper to drop the ore than to hoist it out, which is done now by fifty-four steam engines?

A. Yes, sir; it would be cheaper to drop it down than to raise it up.

Q. Would a tunnel practically abolish all that steam machinery up there?

A. It would to a large extent; yes, sir.

Q. To a very large extent?

A. Yes, sir.

Q. The ore could be dropped down into the tunnel, or rather lowered down, at a very trifling cost?

A. Yes, sir; comparatively trifling, looking at the present expense of getting it out.

Q. Well, the expense of bringing the ore from the mines to the mouth of the tunnel, it is stated here, can be put down as low as seven cents a ton?

A. Seven cents a ton a mile?

Q. Seven cents a ton for the whole distance.

Mr. SARGENT. What report have you, Mr. Sutro?

Mr. SUTRO. It is a report by Mr. Carlyle, a very eminent engineer and intelligent mechanic. He gives the comparative costs here of taking out ore. In the first place he does it by horses. He says that one hundred horses, at two hundred dollars each, will cost \$20,000, and the cost of running that appliance is as follows:

Three per cent. per month (you know they are liberal in interest) interest for one day on \$20,000 is-----	\$20 00
And six per cent. per month for wear and tear is--	40 00
Feed for one hundred horses, at \$1 50 each per day, would be-----	150 00
Fifty drivers, at \$3 50 each per day-----	

Mr. FOSTER. I don't understand it is proposed to use horses?

Mr. SUTRO. No; I am giving some comparative statements here; I am instituting a comparison. Fifty drivers, at \$3 50 each per day, would be \$175; that is, \$385 per day. And if we assume the total extraction of ore and rock at three thousand tons a day, this gives a cost of thirteen cents per ton, which is a very fair estimate.

Mr. FOSTER. Is that for the whole distance, sir?

Mr. SUTRO. The whole distance.

Mr. FOSTER. Well, the cost of transportation is a practical thing, that practical railroad men can tell. Running through a tunnel, it would be at a little increase in cost. They would have to go with greater care, and the wear and tear would be greater?

Mr. SUTRO. Where there is much transportation, I think the general estimate is two cents per ton per mile. The tunnel would be four miles long, and at that rate it would give a cost of eight cents. But here is another method, which is the proper method to employ, and that is the one we have been calculating upon. I will describe now the method which ought to be employed in the transportation of the ore from where it is mined to the mouth of the tunnel. It would be by an endless rope, a wire rope, and a stationary engine at the mouth, a wire rope, running on rollers and pulleys, and running like a belt, such as is used very extensively in the mines of England. As fast as cars are loaded they are clamped on to the rope and are drawn out. There is a continuous coming in and going out. The moment a car reaches the mouth of the tunnel, the clamp detaches it, and leaves it free to move off. That is the system, in brief, to be employed. The total cost will be \$49,328.

To get at the daily expense to run this apparatus, Mr. Carlyle gives us the following figures:

Three per cent. interest per month for one day on

\$50,000 ----- \$50 00

Five per cent. per month, wear and tear, one day	
on \$50,000-----	83 33½
Two and one-third cords of wood, at \$8 per cord-----	18 66½
Two engineers, at \$5 per day-----	10 00
Oil, tallow, and general findings-----	10 00
Attendants-----	40 00
Total-----	<u>\$212 00</u>

Or 3,000 tons, at seven cents per ton, for a distance of four miles.

Mr. WALDRON. By this calculation, it is meant that the whole apparatus shall be replaced in twenty months?

Mr. SUTRO. Yes, sir. These figures have been made with great care. This was intended to be submitted to financial men, so that there should be no caviling. Including everything, wear and tear and interest, and the wages of the necessary employees, with an extraction of 3,000 tons of ore a day, this method gives us transportation to the mouth of the tunnel at the rate of seven cents a ton.

Hearing by the Sub-Committee on Mines and Mining, appointed February 12th, and consisting of Messrs. JAMES S. NEGLEY, WALTER L. SESSIONS, FRANCIS E. SHOBER, and CHARLES W. KENDALL.

FRIDAY EVENING, FEBRUARY 16, 1872, AT 7½ O'CLOCK.

The CHAIRMAN. Gentlemen of the committee, Mr. Sutro has requested the opportunity to continue his examination before the sub-committee as before the committee of the whole, and, there being no objection, he will now proceed. I have indicated to Mr. Sutro, and will now to Mr. Sunderland, that, in order to prevent the continued recalling of the members of the commission appointed to examine and report on the tunnel, it will be best for the gentleman on the one side to put his interrogatories, and the gentleman on the other side to follow. If there be no objection to that we will so proceed.

Mr. SUTRO. Shall I commence?

The CHAIRMAN. Just go on with your examination, if you desire.

Mr. SUTRO. Well, Mr. Chairman, I would ask General Foster now whether he is familiar with the cost of transportation on railroads generally?

Mr. FOSTER. No, sir; not very familiar.

Q. Have you any idea how much it costs per ton a mile?

A. I have an idea; yes, sir; but no accurate one.

Q. Well, what is your idea of the cost?

A. Well, three or four cents per ton.

Q. Three or four cents; on ordinary railroads?

A. On ordinary railroads, yes.

Q. That cost would be increased somewhat in a tunnel, I suppose?

A. Yes; on account of the slowness and care that must be observed in running the trains, the additional caution

to be exercised, and all the elements of expense that go to make up the cost of running trains.

Q. Have you made any comparison between the cost on different roads, in order to arrive at your estimates?

A. No, sir; no.

Q. I made inquiry of General Dodge, who is a very experienced railroad man, a few days ago, and he told me the average cost is about a cent and a quarter a mile?

A. Ah!

Q. In regard to lowering rock from shafts into tunnels: are you acquainted with the kinds of apparatus usually used for that purpose in mines? Here is a drawing of one in Mr. Carlyle's report. [Exhibiting draught.]

A. I have never seen one of those in operation, but I have examined that plan, and I don't see any reason why it shouldn't work.

Q. The operation is by a double shaft, with a car attached to a wire rope, which passes over a double pulley, and the loaded car going down pulls up the empty car. That is, the loaded car pulls up the empty car and the cage.

Mr. SHOBER. What is it loaded with going down?

Mr. SUTRO. It is loaded with ore or rock.

Mr. SHOBER. I thought it was to hoist the ore?

Mr. SUTRO. No, sir; it is to lower the ore into the tunnel. The operation is carried out by having a brake attached to a wire rope, which regulates the motion, and the loaded car going down draws up the empty car. Do you see any difficulty about that operation, General Foster?

Mr. FOSTER. No, sir, I do not, with proper brakes.

Mr. SUTRO. All that would be required is, a brakeman to stand by the brake, who shall lower the ore down and stop it at the different stations as the signals are given.

Mr. SUNDERLAND. The committee will understand that all this that is taken down is not General Foster's testimony.

Mr. SUTRO. Whatever transpires will appear in the report, which is to be printed. It will be necessary for me to

elaborate my questions somewhat, because they are intricate questions.

Mr. SUNDERLAND. I know, Mr. Sutro, you may very often make a long statement, to which General Foster does not make any reply at all; and I see it is all taken down. I don't know whether it is taken down as testimony or not. If it is only shown it is not testimony, that is all I want.

Mr. SUTRO. I think it will clearly appear in the report what is a question, what is a statement by me, and what is a statement by General Foster. It will clearly appear, as you will see from this report of last Monday's hearing.

Mr. SUNDERLAND. I haven't seen that.

Mr. SUTRO. No, sir; because it has just been printed. Here is a proof-sheet of the last proceedings.

The CHAIRMAN. I have no doubt the committee would desire direct interrogatories and replies, so far as practicable.

Mr. SUNDERLAND. I should very much prefer it, as far as I am concerned.

Mr. SUTRO. Have you any idea, General Foster, how much it would cost per ton to lower it in the manner shown?

Mr. FOSTER. We estimate it would cost ten cents per ton.

Mr. SUTRO. Then, according to your statement here, it costs ten cents a ton to lower it. I think that is the statement you made?

A. Yes, that it would cost ten cents a ton.

Mr. SUNDERLAND. Did I understand the chairman to say he desires me to ask questions as we go along?

The CHAIRMAN. No, sir. It is intended for you to proceed after Mr. Sutro and members of the committee.

Mr. SUTRO. I understand you I am to proceed now, and Mr. Sunderland is to come on afterwards.

Mr. SUNDERLAND. That's it. I didn't understand the chairman; that is all. I wanted to understand it.

Mr. SUTRO. According to this statement, Gen. Foster, you say it costs ten cents to lower the ore. Was it three

or four cents a mile cost of railroad transportation that you stated?

Mr. FOSTER. I stated that I am not acquainted with railroad transportation.

Q. But your idea?

A. That was my idea.

Q. Well, at that rate, for five miles it would cost 25 cents, and ten cents to lower it, would make 35 cents per ton to take the ore out of the mine and deliver it at the mouth of the tunnel. That corresponds with your figure, I believe?

A. No; five miles, at three cents, would be fifteen cents, and ten cents for lowering, is twenty-five cents.

Q. Twenty-five cents. Then, according to this *modus operandi*, it would cost twenty-five cents per ton to take the ore from the mine and deliver it at the mouth of the tunnel?

A. I don't say that it can be delivered for that; I simply say that that was my general idea about railroad transportation. Of course, in a tunnel the expense would be much greater.

Q. How much greater do you think?

A. I don't wish to make any new estimates, Mr. Sutro.

Q. You do not?

A. None at all. I don't appear as an expert upon railroad transportation, and don't want to be drawn into making any statements which might conflict with established facts.

Q. Well, I will leave that subject now. I will go into the report of Mr. Day. I want to ask a few questions in regard to that, as far as your own knowledge and observation in regard to the operation of the tunnel is concerned.

The CHAIRMAN. Mr. Sutro will you be so kind always as to designate the page from which you are reading, so that the committee, in perusing the testimony, may be enabled to turn to it without any delay?

Mr. SUTRO. This is on page 26.

The CHAIRMAN. What is your question?

Mr. SUTRO. I wish to read from the Commissioners' Re-

port, from the Appendix of the Commissioners' Report, on page 26. Mr. Day, after speaking about the completion of the tunnel, with all its drifts, goes on to say:

"We have, to begin with, (page 19, 'Sutro Tunnel,') three thousand miners to carry to and from their work an average distance, from the mouth of the tunnel, of four and a half miles. These three thousand miners, divided into three shifts of eight hours each, give us one thousand men on each watch. Allowing ten men to a car, it would require one hundred cars to convey the men into the tunnel. The train would occupy twelve hundred or fifteen hundred feet in length of the tunnel, and when the head of this train would reach the place of destination the rear cars would be quite an inconvenient distance back from the place of destination, thereby creating much confusion and more or less delay."

If the apparatus to convey the cars into the tunnel by wire rope is so arranged that it goes along the main tunnel and along the drifts, do you see any difficulty in stopping that train at each shaft as it arrives, and letting the men off?

Mr. FOSTER. No, sir; I think it can be arranged so as to operate with perfect facility.

Q. With perfect facility. Then there would be no such emergency arise as is supposed here by Mr. Day, of a train twelve or fifteen hundred feet in length, from which a thousand men would have to get at once. They would, however, be allowed to get out at their respective stations, and there would be no confusion?

A. Well, it would depend entirely upon the facilities that are provided—upon whether facilities are provided for switching off the cars at the proper stations. I should think the men ought to be left directly at the drifts leading to the different mines.

Q. Now, Mr. Day goes on to say:

"At this point the miners' greatest trouble begins, their respective stopes and places of work being far above them. They commence to climb the ladders, and go up various heights, many from five hundred to one thousand feet. They arrive at the place where their day's work is to be done in an exhausted condition, positively unfit and unable to do a day's work."

Provided these men go in a railroad train and arrive at their respective stations, and then this apparatus, which it is proposed to apply, hoists them up, will there be any difficulty? Will there be any difficulty in hoisting these men up on the empty cage, to any point desired, by lower-

ing ore down on the other side, by having a counter-balance of say one or two tons?

A. They can hoist the cage up as far as the pulley is fixed.

Q. Supposing that pulley be fixed near the top?

A. Well, then, they can be hoisted up to that level.

Q. Do you see any difficulty (as is done now from above, in giving signals to those below) in signalling the brakeman where to stop?

A. I don't see any—no, sir. I think the apparatus ought to be made to work with proper arrangements.

Q. Then the men do not arrive in an exhausted condition. They go up very comfortably. They go up the same as they go down now.

A. Well, I don't know about that. They can go up as high as that pulley is established. If they have to go any higher, of course they have to climb.

Q. Well, suppose they have those pulleys established at the top?

A. They can go as high as that.

Q. They could be landed at any station?

A. I don't know of any particular labor that would exhaust them. Of course you suppose that men are there to operate the machinery, and men are there to put on the loaded cars to act as counterpoise.

Q. Precisely. This apparatus, then, which one man will work, would take the place of a ponderous steam-engine, would it, think you, general?

A. Well, I do not know whether it would entirely dispense with a small engine. I have my doubts upon that point.

Q. What obstacles are there?

A. I think there may be emergencies which would require some power there, but to what extent I cannot say.

Q. You have stated that they take fifteen hundred pounds of ore in their cages now, and hoist it up; they certainly can lower that much?

A. I wouldn't like to say that I am perfectly sure that

that would work without additional power. I think it will, but I see there are many circumstances that would arise where you would want a little power.

Q. Well, supposing you put in a load here of, say, three thousand pounds on a car, against an empty car here, (three thousand pounds and a car against an empty car,) would that go down with immense velocity?

A. It would go down with very great velocity. It would depend upon the height.

Q. Supposing you put three thousand pounds in here, and ten men in here that would weigh fifteen hundred pounds, wouldn't it go with immense velocity, with fifteen hundred pounds over-weight on the other side?

A. Well, if you let it go fast, it would go very fast.

Q. Would there be any difficulty in making that go at any required speed?

A. The trouble would be in controlling the machine. You cannot stop such a moving body immediately. You cannot let it go too fast, because, if you do, you cannot break it up sufficiently quick when it gets to the bottom. The motion must be such as to permit you to stop it a moment's notice almost.

Q. Do you think five hundred feet a minute would be too great a speed to stop?

A. No, sir.

Q. They could do that conveniently, could they?

A. Yes, sir; I think so.

Q. Then, according to this, the brakeman here would take the place of all these engineers and firemen on top, and would supply the place of all the steam power that is up there, or nearly all; that is, after this arrangement is put in operation?

A. Yes, sir; provided no additional power is needed here.

Q. I will read on further:

"The timbers used in the various mines are to be conveyed to their respective destinations by the same tedious, slow, and expensive routes; expensive, because time in this country is money—in fact, the most expensive commodity that is employed in the working of these mines."

Can you perceive any difficulty in getting timbers in on this railroad, if you have cars constructed for that purpose, and hoisting them up by the same means that we have just described?

A. Well, it is more difficult to move timber than it is to move men. The cars, if properly switched off, could not properly be brought in directly to the bottom of this shaft. Timbers would have to be moved by hand a certain distance at least. They would have to be unloaded from the cars.

Q. Would they not, on the surface, have to unload it from the cars, and load it on the cage, in taking it down to the mines?

A. Well, in surface working the teams are generally driven up very close to the shaft, the timbers are run in, and the cage is lowered directly in the shaft. Here the cars stop some distance off, necessarily, because the branch tunnel would not be directly under the shaft. It then has to be conveyed in by a drift on the bottom of the shaft.

Q. In delivering timbers on the surface, are they not generally put into a place for storing, and taken out when required, and then framed first?

A. Yes, sir.

Q. Well, then, they will have to load them at a time when they will be required?

A. Yes; but they usually have them in shops adjoining for the machinery; and they have little cars there with which they can take them right to the mouth of the shaft.

Q. Will there be any difficulty in running under the place where you put them in the cage?

A. There would be more difficulty than on the surface, on account of the confined space. It will be more difficult to have a place of size enough to admit of all this carriage.

Q. I don't mean to say that these timbers are to be stored at the bottom of the shaft, but that they are to be conveyed in when required—two or three sets put into a cage, and carried to the place of destination. That wouldn't require much space, would it?

A. I should think it would.

Q. It would require some space?

A. You cannot carry timbers through a long, narrow drift easily.

Q. You would have to have a chamber at the bottom of the shaft?

A. Yes, sir; it would be more difficult than conveying it from the surface.

Q. How much additional expense do you think it would be per thousand feet. Have you any idea?

A. Well, I should think it would cost twice as much to carry it and to load it.

Q. Have you any idea how much it costs to carry it from the carpenter's shop to the shaft?

A. It would cost very little. They load it directly from the cars, usually, where they have that arrangement, as at the Ophir, with the shops close by the engine-house.

Q. Do you think it costs a dollar a thousand feet?

A. I have no idea, sir.

Q. In running the men in through the tunnel, at what rate of speed do you think that railroad could be operated?

A. I think it could be run eight hundred feet a minute.

Q. Eight hundred feet a minute?

A. About eight or nine miles an hour. About nine miles an hour.

Q. Our calculation was ten miles an hour; that comes close to your figures.

A. Pretty nearly that.

Q. Then, according to that, how long would it take to run these men in five miles?

A. About half an hour.

Q. About thirty minutes?

A. Yes, about thirty minutes.

Q. About thirty minutes to run them in. I said from the point where they are left they could be hoisted to their place of destination at nearly the same rate as they could be sent from the surface down below?

A. Nearly the same; yes, sir.

Q. How many men can they lower at a time?

A. Ten men, I believe.

Q. How long does it take?

Mr. SUNDERLAND. Is that on a single cage, general, or a double cage?

Mr. FOSTER. Well, I think that is on a double cage; although they can crowd more on that. They cannot get ten men on a single cage.

Mr. SUTRO. They can get on about six.

Mr. FOSTER. Well, there were five on when I went down, and they were squeezed nearly to death.

Mr. SUNDERLAND. Yes, I know they squeeze these men harder than they do you.

Mr. FOSTER. I don't see how they can get on more than five. There is nothing around the cage; you have to hold to the bars. I don't know how many they carry.

Mr. SUTRO. You think about ten men?

Mr. FOSTER. Five on a cage; they may carry more. Yes, ten men.

Q. Ten men?

A. I don't know how many they will carry, but I should think five as many as could go down on a cage safely.

Q. In lowering men, do they run the cages as fast as they do in lowering rock?

A. I believe not; no.

Q. How long do you think it takes to lower a gang of men two thousand feet deep, and have the cage come back and hoist out another gang? How long will it take to have the cage go down with ten men, and bring ten up, at the speed run at in lowering men? I mean including the delays, and having the men get on and off below and hoisting?

A. I should think it would take ten minutes.

Q. Ten minutes for a round trip to a depth of two thousand feet?

A. Yes, sir.

Q. Well, supposing these three thousand miners were

all to go down in one shaft, (I only suppose a case now,) there would be—

A. I think that I have got that too finely estimated.

Q. Well, we will say three thousand men are employed in three shifts: one thousand in a shift, of eight hours, duration. It would take them, according to your figures, one hundred trips to lower a thousand men in one shaft and hoist out another thousand. They only lower them when they change shifts; consequently, when you lower the one thousand down the other thousand comes up. Ten men in ten minutes gives us for the whole thousand men just a thousand minutes. It gives us about seventeen hours to do it in, if we are doing it all in one shaft. Now, supposing these men are divided among ten shafts, (you have reports here from seven different superintendents; we will call it ten deep shafts,) it would take an hour and seventenths to get the men down and up. That is what it would take, general, is it? Have you followed my figures?

A. Yes; I tried to.

Q. Well, you see here are a thousand men. It takes a hundred trips to lower them down, because ten men go in a trip. Is that correct?

A. Yes. Very good.

Q. Then, at ten minutes a trip, it gives us a thousand minutes.

A. Very good.

Q. A thousand minutes is sixteen hours and sixty-six one-hundredths of an hour. It would take that if we had but one shaft. But supposing there are ten shafts—at $16\frac{66}{100}$ hours it would—

Mr. SUNDERLAND. Call it seventeen hours. It don't make any difference.

Mr. SUTRO. I might as well give these figures accurately. If that is divided among ten shafts it would give an hour and sixty-six one-hundredths of an hour to lower down the quota in each shaft. By the tunnel, as we have just shown, they can be carried in in thirty minutes.

Mr. FOSTER. Carried in in thirty minutes?

Mr. SUTRO. Thirty minutes, sir.

Mr. FOSTER. Well, then you have to bring the others out.

Mr. SUTRO. They will come out. They come out at the same time that the others go in. We have a continuous string of cars going in and out all the time.

Mr. FOSTER. Well, the men in there when the others leave—

Mr. SUTRO. Well, it will take another half hour; call it an hour. Now, to take in all the men it would take seventeen hours—and to take them out—in the old way. Mr. Day says time is an expensive commodity. That is what I thought.

"Suppose a cave is threatened in some one of the most distant or inaccessible mines"—

[I am reading right on where I stopped]—

"A car load or two of timbers, immediately and judiciously used, might and often does, prevent a disastrous cave. By the present mode of working in such a contingency as the above, the miner would send his order up, and in a very few minutes the return cage would bring the desired timbers, and in a few minutes more the timbers would be in place, and the threatened disaster averted. How would it be in working through the tunnel? The miner would first give his order for timbers, the order conveyed down the ladder, probably 1,000 feet, to reach the tunnel, then out of the tunnel a distance of four or five miles to the carpenters' shop at the mouth of the tunnel; the timbers procured and sent by return cars to the foot of the upraise, then raised by some as yet unexplained process to the point of danger or trouble."

We have already explained how to bring the timbers in on the cars. Do you see any difficulty, General, in a man coming down by the method proposed into the tunnel, and going to a telegraph instrument, which is supposed to be stationed at the bottom of the shafts, telegraph out to the mouth of the tunnel, and tell them what to send in? Do you see any difficulty about that?

A. None, whatever, with the proper apparatus.

Q. Well, then, it would take thirty minutes to send that timber in?

A. Yes, sir; besides the loading.

Q. It wouldn't take long to hoist it up there?

A. Well, it would take time. I don't pretend to say how long it would take.

Q. It would take a little time. And this, "as yet unex-

plained process," we have explained here a little while ago. [I am reading again from Mr. Day's statement:]

"In this way hours might elapse before the much-needed timbers would arrive, and then they would probably arrive too late to prevent great damage."

Well, we have disposed of that part already.

"Another disadvantage in working——"

Mr. SUNDERLAND. I would like to have the General's answers to any questions that are proposed.

Mr. SUTRO. General, do you consider that disposed of?

Mr. FOSTER. I don't understand exactly what question was asked.

Q. I did not put the question. I will put the question, however, now. I simply read. I will make a question. Mr. Day here states that "hours might elapse before the much-needed timbers would arrive." Do you think that hours would elapse before they could be brought in through the tunnel?

A. Well, I wouldn't like to express myself with regard to the accuracy of that statement. It is perfectly evident that it will take longer (in my mind) to bring the timber in from the mouth of the tunnel, than it would to lower it from the workshops above by the shaft. I cannot pretend to say, without a great deal of calculation, how much longer it would take, but it would evidently take longer, because in this case you have to bring it five miles, while in the other you lower it, say two thousand feet, right down, at railroad speed. There is the difference of two thousand feet against five miles.

Q. In one case it would take ten minutes to lower it; in the other case it would take thirty minutes?

A. No, not ten minutes. Two or three minutes.

Q. Well, say two or three minutes. In the other case it would take thirty minutes to bring it in?

A. Loading and carrying to the bottom of the shaft, yes.

Q. Let me ask you another question, General. If a cave is threatened in the mine, it would probably require five

or ten thousand feet of timber. How much could you carry at one load down in a cage?

A. Well, that I do not know.

Q. It is difficult to tell. It would take a number of trips, however?

A. You could take down just as much as you could pile into the cage, and as much as you could attach.

Q. Well, let us calculate on that once?

A. Certainly, the trips can be made very rapidly. They can run the engine a thousand feet a minute. You can run the cages up and down, and take the timbers down very fast.

Q. Well, you have got continually to be sending the cages up and down?

A. I do not know the particular process of sending timber down, whether they put it in cages or sling it.

Q. They send it down on cages. That is the process, is it not Mr. Sunderland?

MR. SUNDERLAND. Yes, sir.

MR. SUTRO. A dozen trips would take a good while?

MR. FOSTER. They might run a cage up and down in one and a half or two minutes with timbers.

Q. Do you see any difficulty in running in a large quantity of timber in the tunnel?

A. No. You can load as many cars as you want, or you can have cars ready loaded if you choose. As many cars as you take, so much timber can you take. You can take so many car-loads.

Q. Do these caves come very suddenly in mines, or do they come gradually?

A. I do not know about that.

Q. You have not examined into that. They generally tell a day beforehand when there is going to be a cave; that is my experience; the timbers commence gradually to give way. I will read again from Mr. Day's report, where I left off:

"Another disadvantage in working the mines through the Sutro tunnel is, the mouth of the tunnel being located several miles farther from the timber

and lumber supplies, would necessarily increase the cost of the same two or three dollars per thousand more than when delivered at Virginia or Gold Hill."

Do you think, General Foster, that it would cost as much to deliver timber from the mouth of the tunnel by floating it down the river, as it would to carry it from Virginia City?

A. No, sir.

Q. Mr. Day says it will cost more, because it is further off. Do you know at how much less price timbers could be delivered at the mouth of the tunnel than they could be at Virginia City?

A. No, sir; I do not know. It would be just as much cheaper as floating timber down is cheaper than carrying it on the railroad.

Q. Yes, sir. The head of Carson river is in the Sierra Nevada mountain, where the timber supplies come from?

A. Yes, sir.

Q. Do you know what timber costs at Virginia City—summer prices?

A. I believe it was twenty-two dollars a thousand when I went there.

Q. I think you are mistaken, general; twenty-eight dollars a thousand. You are certainly mistaken?

A. I think I have my notes here, and they will show.

Q. It costs twenty-eight to thirty dollars?

A. Here it is; the cost of timber at the Ophir mine, July 21, was twenty-two dollars per thousand delivered. Last year paid \$26 50. Year before paid \$42. Contracts for lumber and wood are made every year with the persons who will furnish the cheapest. The contract price for this year, as I understood him—

Q. May I ask you, General Foster, whether that statement is made by the gentleman who makes these accurate statements in this report?

A. Captain Day; yes, sir.

Q. I find in a report of Mr. Raymond for 1867, some time ago: "Present price of timber and lumber for mining

purposes ranges from twenty-eight to thirty dollars a thousand for board measure." You cannot give us any other figures?

A. The timber of the year before was \$26 50, according to Captain Day. The year before that it was \$42. That is Captain Day's statement.

Q. You cannot give us any figures, however, about the cost for floating down the river. You haven't taken any figures of that?

A. I do not know how much it costs.

Q. It would be decidedly less, however?

A. You would have to provide a flume for that purpose. They have flumes constructed near Carson; but they cost I don't know how much. I think it is stated somewhere in Mr. Clarence King's report.

Q. Mr. Clarence King's report is not here to-night. I will look for that, however, the next time. Well, we disposed of this statement, that this is several miles farther from the lumber supply, and would necessarily increase the cost two or three dollars per thousand.

"The foregoing are some of the practical objections to using said tunnel as an avenue through which to work the mines on the Comstock; and, as a practical miner of more than forty years' experience in various kinds of mining, I make this assertion, that should the tunnel, with its lateral drifts, be offered free of charge, not one mine on the Comstock would be worked through it. And why? Because the present mode of working is cheaper and more expeditious."

If that be correct, General Foster, there won't be much danger of Virginia City being injured, will there? Supposing this statement to be correct, that they won't use the tunnel?

A. I don't want to make any statement with regard to that. It is, of course, a matter of opinion, and I would rather confine myself to what is actually known than give my opinion.

Q. But supposing Mr. Day is correct, and that they won't use the tunnel, even if free of charge, when it shall have been completed, do you think it would interfere with Virginia City in any manner, if the tunnel would not be used for transportation?

A. If it did not alter the status of the working mines, of course it would not affect it.

Q. Mr. Day now goes on to say what enormous prices he will have to pay to the tunnel company. It is too lengthy to read it all. He shows how much they would have to pay per ton to get this rock and ore out. Then he goes on to state how much it would cost to transport the miners in and out. He says it will cost \$1,779,375 a year. The total for the transportation and taking the miners in and out would cost \$1,779,375 a year. That is taking the transportation at \$1 12½ per trip?

A. Yes, a little less than what we took it. We took it \$1 25, considering it five miles.

Q. And the balance he gets at by counting fifty cents for two hundred men in and out. Then he goes on to say there are sixteen million feet of lumber that have got to be taken in, which amounts to \$37,500. The whole amounts to \$1,816,875. Then he concludes this way:

"But thus far there is one redeeming feature in the contract; it is this: it is optional with the different mining companies whether they pay any or all of the beforementioned tariffs, for if they do not work through the tunnel, they need not pay any of them."

Do you understand it is compulsory for them to work through the tunnel?

MR. SUNDERLAND. That is a matter of construction of the contract altogether. I do not see that there is any propriety in asking that question. It is not a question for the witness to answer at all.

MR. SUTRO. Well, we will take Mr. Day's statement for it. He says they need not pay for it unless they want to.

MR. SUNDERLAND. No, we won't take his statement at all. We will take the contract.

MR. SUTRO. I am reading his statement. Now he goes on to say:

"We now come to a tax that is more arbitrary in its character. No mine on the Comstock lode can escape its provisions. It is what is termed the two dollars per ton royalty, which is intended to be a compensation for draining the mines, and is claimed to be a cheaper mode of drainage than that of pumping, the mode now in use. I will now proceed to the consideration of that branch of the Sutro tunnel question, practically considered. These mines have been worked for about twelve years, more or less extensively."

Mr. Day here speaks about paying a royalty of two dollars per ton. Do you know on what this royalty is to be paid, General Foster?

Mr. FOSTER. Paid on the ore that is taken out.

Q. On paying ore?

A. Well, I am not intending to construe the law. They are to pay two dollars royalty on what is prescribed by the law. I think that is the law.

Q. There is no law about it; it is a contract.

Mr. SUNDERLAND. All ores that are worked are sold.

Mr. SUTRO. (Reading:)

"—— provided said sum of two dollars per ton on the ore extracted, which said second party shall have reduced at some mill or other reduction works, or shall have sold."

That is the way it reads in the contract at that point. Mr. Day goes into more elaborate figures to show that it would cost \$1,095,000 in royalty on the Comstock lode. It is at the bottom of page —.

Mr. FOSTER. Taking the daily yield as fifteen hundred tons?

Mr. SUTRO. Yes, sir; he makes it out as \$1,095,000. Were they taking any ore out of the Ophir mine while you were out there?

Mr. FOSTER. No, sir.

Q. How much would the Ophir mine have had to pay to the tunnel company in the last four years and a half, if they took out no ore?

A. I do not know how long it has been since they took out any ore.

Q. Well, say since their new shaft was started?

A. Well, I suppose they would pay no royalty while they took out no ore.

Q. How much would the Ophir company have paid the tunnel company since they started their shaft, which was started, according to the statement given here in Mr Raymond's report, on the 18th of August, 1867, (he states here on the 18th of December: "the old mine and shaft were abandoned sixteen months ago, since which time work has

been progressing on the new shaft, without, however, striking any ore.") They have not struck any ore since.

A. They would have paid nothing, as I understand it.

Q. Well, supposing the tunnel would have offered the Ophir company drainage and ventilation without contributing one single dollar to the tunnel company while they were hoisting out the waste rock to the surface, would you consider that it would have been an advantage to that company to have had the tunnel in?

A. While they were sinking this shaft?

Q. Yes, sir.

A. Well, while they were sinking the shaft it would have been no advantage to them except as drainage.

Q. Supposing the tunnel had been finished at that time when they commenced constructing that shaft, and the drift had been run from the tunnel, and they had sunk a bore-hole, as they bore oil wells, and connected it with the tunnel, wouldn't it have completely drained their mine, and given them ventilation at the same time?

A. It would have drained the shaft probably. I don't know about ventilation, because this hole might have become choked up so as to prevent the entrance of air.

Q. Would not the water passing through there make some ventilation?

A. I do not know that it would.

Q. Supposing the hole was large enough, so that it would not be quite full of water?

A. If traps should occur in the hole there would be no passage of air.

Q. Could they not be removed, General? Is there any obstruction in the way?

A. Well, a small drill hole would hardly aid much.

Q. Call it an-eight inch hole?

A. An eight-inch hole would make it.

Q. General Negley, are you familiar with the oil wells in Pennsylvania?

The CHAIRMAN. Yes, sir.

Q. How large are they?

A. They range from four to ten inches.

Q. Is there any difficulty in making a ten-inch hole?

A. Not the slightest.

Mr. SUNDERLAND. What kind of material are these holes bored through, General: ground that don't swell or retains its position?

The CHAIRMAN. Well, it is quite variable. They have to case most of them. The first four hundred feet are through variable rock; then they strike sandstone. They strike the first, second, and third sandstone rocks, which comprise the formation, between there and the depth of a thousand feet.

Mr. SUNDERLAND. We have a clay there that nothing withstands the expansive power of it.

Mr. SUTRO. Is there any difficulty in driving pipes down those bore-holes?

The CHAIRMAN. No, sir.

Mr. SUTRO. There could be no difficulty if we drive a pipe down, General Foster.

Mr. FOSTER. With a sufficient sized hole, I think there would be no trouble about the passage of air.

Mr. SUTRO. General, at our last examination it was shown that the Ophir company collected something like \$800,000, that they had spent \$423,000 in prosecuting the work on the shaft, and had erected machinery to the cost of \$173,000. Now, supposing that bore-hole had been down, so that the men would not have been hampered in working with water in the bottom, they would not have been bothered in pumping and being flooded. Do you think that that shaft could have been made at less cost?

A. The tunnel completed?

Q. The shaft, provided the tunnel be completed, sir?

A. Yes, sir; I think it could have been done at less cost.

Q. According to Mr. Day's figures it has cost them \$173,000 to make the shaft and the drifts. Do you think that this shaft could have been made for less money, less than \$173,492 20, provided that bore-hole had been put through

and the shaft sunk, under the facilities that would have furnished?

A. Yes, sir; I think it would.

Q. Supposing this bore-hole had been put in, General, and an accurate survey made, and no machinery at all erected on the surface, do you think it feasible to have constructed that shaft from the bottom, going up, without any machinery at all?

A. It could have been done.

Q. Then it would have come down simply to the labor of the men?

A. Yes, sir.

Q. And the powder used, without any machinery whatever?

A. You say without any machinery whatever. That would be impossible, because everything that you use is a machine. Machinery for lowering might have been used.

Q. Steam machinery, I mean?

A. You have got to have this machinery for lowering.

Q. Yes, sir.

A. It wouldn't be necessary to have the steam-pumping machinery that they now use.

Q. Mr. Day goes on to state that there is no water in the mine, that there is almost a dry fissure, and he says it is a dry country, etc. I don't want to go into this pumping just now, about the quantity of water in the Comstock lode. I will go from that for the present. I will come back to that by and by:

"As a ventilator, this tunnel, if finished, would amount to just what a connection between any two or more mines would—no more and no less. Neither one could possibly be made to ventilate any exploring or prospecting work, for which some mode of artificial ventilation, either by patent blower, air-pumps, or some other more efficient method, is necessary."

I think, General, in your report, you state that the mines may be ventilated by having two shafts which exist on the vein connected by drifts, so that the air may go down one and come up the other through the draught?

A. Yes, sir.

Q. That you know; you have seen that?

A. Yes, sir.

Q. In what mine have you seen that, General?

A. Crown Point; Yellow Jacket.

Q. Crown Point and Yellow Jacket. Do you recollect, General, how far they are apart?

A. I do not recollect as shown on the map.

Q. Crown Point shaft, from this map here, and the Yellow Jacket shaft, I should judge are 600 feet apart. Do you think that is about it?

A. Yes, sir.

Q. About 600 feet. In going down the Crown Point shaft they have a drift from both sides, and have connected their drifts, and thus they have created ventilation. How would you ventilate the shaft, say between the Imperial shaft and the next deep shaft to it, the Hale and Norcross, which is a distance of 3,000 feet; would you think it possible to make a connection there at each level of a hundred feet, and ventilate a mine between those two points?

A. Well, it is feasible, certainly; they might run a drift that distance.

Q. Well, do you think it is practical to do it, to run three thousand feet every time you sink down a hundred feet?

A. Well, the better way would probably be to sink a second shaft.

Q. That is the point I want to get at. The Comstock lode, I believe you stated, is something like 20,000 feet in length?

A. Twenty-two thousand.

Q. Now, how many feet of that lode are actually productive in depth; how many of the mines that have reported, leaving out the others, are productive in depth; let us take them as they come. Here is the Ophir; has the Ophir any ore in depth?

A. The Ophir has none.

Q. The Gould and Curry; have they any ore in depth?

A. Yes, sir.

Q. I beg your pardon; I will read from their own state-

ment: that will probably give us the best idea how to get at it. I will take the Gould and Curry, and show you what he states in regard to it.

Mr. SUNDERLAND. Which report is that you have—Mr. Batterman's?

Mr. SUTRO. That is Mr. Batterman's Report, on page 33. To question 11, which is this:

"How long a time, at the present progress of working, will it require to exhaust all the profitable ore in the mine above the 600-foot level?"

He answers:

"There is no known body of ore existing above the 600-foot level, that could be profitably worked at the present cost of reduction."

No. 12 question:

"How long between the 600 and 1,000-foot level."

Answer.

"No paying ore has ever been found in this mine below 600 feet."

That is according to the statement of the Gould and Curry company. There is no ore below; consequently their work in depth is prospecting only. Is that so, General?

A. They have plenty of ore there. He says their ore is not profitable at the present reduction.

Q. Above the 600-foot level, or between the 600 and 1,000-foot level, the tunnel will come in at 2,000 feet. My question is this: Below the 600-foot level, in the Gould and Curry mine, would not all their work be of a prospecting nature simply?

A. Well, that is difficult for me to say. It appears to be prospecting now. I wouldn't undertake to say that they won't discover ore there pretty soon.

Q. Well, I mean to say at the time you were there, when this statement was furnished you, they were simply prospecting?

A. Yes, sir.

Q. Well, considering that, would they have to pay any royalty to the tunnel company in this prospecting work?

A. As I understand the law, they would not.

Q. Well, then, the Ophir company and the Gould and Curry company would have had the benefit of this tunnel

ior nothing; that is to say, the drainage and ventilation would have paid nothing to the tunnel company?

A. While they were prospecting they would have had the benefit.

Q. The next company is the Savage. You see what his reply is to that question. Answer to question 11:

"Six months' time, at the present rate of working, will exhaust all the profitable ore in sight above the 600-foot level."

Answer to question 12:

"Six months' time will also exhaust all profitable ore in sight between the 600-foot and 1,000-foot level."

How long before the tunnel could get in?

A. In about three years.

Q. Well, in six months it would be exhausted, and all their work would be of a prospecting nature; they would pay no royalty. They can pay no royalty till the tunnel is finished; and they say in six months it would be exhausted?

A. Well, they might find other ore again very soon.

Q. Well, we don't know but they must prospect for years?

A. And they might strike a bonanza at any time. They have struck a bonanza now. That is an answer to it. They have prospected until this time, and now they have struck ore.

Q. They have struck the bonanza there. They didn't know that they would when you were there. Are they likely to strike bonanzas anywhere on the Comstock lode?

A. Yes, sir; anywhere.

Q. Do you think they are likely to strike it at very low depth?

A. Yes, sir; I found it so from different evidence that appeared.

Q. How long have the Bullion company worked their mine without finding any ore?

A. I do not know—a long time.

Q. How long do you think?

A. I don't recollect.

Q. They started when the other mines started. Don't

you think it is ten years? Don't you think they have been prospecting ten years?

A. I don't know anything about it. There is no use of my guessing at it.

Q. Well, they have spent \$1,144,500. That is what they have paid in assessments?

A. That is what they have paid in the Bullion?

Q. Yes, sir.

Mr. SESSIONS. Is that on the Comstock lode?

Mr. SUTRO. Yes, sir. So the Bullion company would not have paid the tunnel company anything?

Mr. FOSTER. Not during that time; no, sir.

Q. Now comes the Chollar Potosi company. Question No. 11:

"How long a time, at the present progress of working, will it require to exhaust all the profitable ore in the mine above the 600-foot level."

Answer.

"At present rate of working, three years will exhaust all the ore in the mine—that is, all the ore that is known to exist."

It will be all exhausted by the time the tunnel comes in, will it not, General?

A. According to that statement.

Mr. SUNDERLAND. "All that is known to exist," he says:

Mr. SUTRO. Yes, sir. Answer to question 12:

"Up to this date no ore worthy of mention has been found below the 600-foot level."

So they would have to pay nothing there until they found something. Now, let us take the next one, which is the statement of Mr. R. N. Graves, of the Empire company.

Answer to question 11:

"All the available ore from the 600-foot level to the surface is exhausted, unless the cost of milling be reduced,"

or transportation, I suppose, also. Answer to question No. 11:

"From the 600-foot level to our present lowest, or 1,300-foot level, the vein in Imperial and Empire mines, has been comparatively barren."

Would this company have to pay any royalty, General?

A. A royalty on what ore they get out.

Q. But, then, after the ore is exhausted on the upper

level, would they, while they are prospecting, pay any royalty?

A. Not while they are prospecting, getting out no ore.

Q. Now let us take the next one. The next one is the Yellow Jacket company, but I don't find the statement; no matter. Now let us come back to where we stopped, at ventilation. According to what we find in this report, a large portion of the Comstock lode is unproductive. Then we have not included yet the Sierra Nevada mine, the Utah mine, the Allen mine, the Mexican mine, all of them unproductive: the Ophir north mine, the Central mine, the California mine, the White and Murphy, the Best and Belcher, the Gould and Curry.

A. Yes, but I understand they were getting ore out of the Utah mine. They were when we were there, I think. They were sending some ore out of the Sierra Nevada.

Q. The Sierra Nevada were getting some ore from the surface. They were not mining deep at all, they had given that up. There is not a single mine got any ore in depth. Consequently, all these gentlemen here, who complain about paying, would not have to pay a single dollar to the tunnel company, not a single dollar. But I am diverging, I want to go back to ventilation.

A. Well, these mines, which are quite unproductive, would of course, on all the ore they would get out.

Q. Yes, but they show it is exhausted, and consequently they would have to pay nothing, the work is only for prospecting; when they discover new bodies of ore, they have to pay. We would ventilate the mines, and then they could go on prospecting, as I will show. You state that it is not practicable to connect two shafts at a great distance apart, say three thousand feet?

A. I said it was practicable.

Q. You said it is feasible; yes, sir, practical. But it wouldn't be advantageous to do it?
it wouldn't be advantageous to do it?

A. That I would not undertake to say.

Q. Would you say it would be so to connect shafts three thousand feet apart every one hundred feet of descent?

A. I wouldn't like to make any statement about it. It might be advantageous under certain circumstances.

Q. But what I want to get at is, is there any extraordinary difficulty in going three thousand feet without any ventilation? If you will permit me, I will read a statement here from one or two of the mines in regard to the cost.

Mr. Graves states on page 43—

"The size of our drifts, usually 6 by 9 outside of timber, with good cool air, can be run for \$7 per foot in hard-blasting ground. The same ground, with the thermometer 110°, will cost \$32 per running foot, or 59 cents per cubic foot."

Now, let me call your attention to another place here in the report of the Yellow Jacket mine, from Captain Taylor, on page 44. He states:

"The cost of drifting, like cost of sinking shafts, depends on character of ground and temperature of air. Have run drifts in hard-blasting ground, (cool air, size full,) 6 by 9, for \$7 per running foot, or 13 cents per cubic foot of earth removed. Same ground, with temperature of air 107°, cost \$30 per running foot, or 55½ cents per cubic foot; cost of labor of timbering included in the above. With cool air made 3½ feet per day; with air at 107°, 20 feet per month."

Now, I want to ask you, General, provided they get down over 1,000 feet, and would have to drift 3,000 feet, would you consider it an advantageous thing to do, to make these connections, in view of these statements?

A. No.

Q. It costs five times as much nearly to make those drifts. Well, to go back, then, to this question of shafts: how many shafts do you consider, General, on this whole length of 20,000 feet, ought to be sunk to make mining thorough and advantageous and systematic on the Comstock lode—what distance apart?

A. That is very hard to say.

Q. What distance apart do you think these shafts ought to be, in order to make mining intelligible, to explore that lode down to the tunnel level, to bring them near enough together, that they can make these connections without difficulty, say like the connection between the Crown Point shaft and the Yellow Jacket?

A. I wouldn't undertake to say.

Q. Would you consider that a reasonable distance?

A. My answer would be a mere guess.

Q. Would you consider that a reasonable distance between the Crown Point and Yellow Jacket?

A. Yes, a reasonable distance.

Mr. SHOBER. What is that distance?

Mr. SUTRO. Six hundred feet on the map. Now, supposing, General, thirty-three shafts were down from the surface connecting with the tunnel, would you think that under those circumstances there would be any difficulty in making these connections?

A. None, whatever.

Q. Supposing, then, that thirty-three shafts were sunk on the whole lode, which are quite difficult to sink now, as we have seen in the case of the Ophir company, who have been four and a half years getting down twelve hundred feet—supposing these bore-holes were made connecting with the tunnel, and after the bore-holes were made, the shafts were made from below and also from above—don't you think that a perfect system of ventilation might be brought about?

A. Certainly.

Q. Is the character of the bodies of ore in the Comstock lode continuous? Do they find continuous bodies of ore?

A. No. They find them separate, in different places in the vein.

Q. The drifts which have been made in order to reach this ore are very considerable, are they not?

A. Certainly.

Q. I have a statement here of the Gould and Curry company for the past year, which has just been published and came to me a day or two ago. The same gentleman who furnished you with the statement says here:

"12,256 feet of drift have been run during the year."

Now, looking at that statement of a single mine drifting 12,256 feet, and the statements I have just read from the superintendent of the Yellow Jacket company and the superintendent of the Empire company, that it costs three,

four, and five times as much to make these drifts in foul air as it would in pure, would it not be of immense advantage to the Comstock lode, and to the exploration of it, if they would have 33 shafts down so that they could make connections?

A. Well, they could make air shafts by boring down to the different drifts.

Q. From what point?

A. From the surface.

Q. But would that supply ventilation where you have a bore hole, say ten inches in diameter; would that supply ventilation in making drifts at every level of a hundred feet?

A. Yes, sir; I should think it would. I should think ten inches ought to supply it. I think the pipes are eight or ten that now carry down the air.

Q. Supposing you had these bore holes down, how would you prospect your mine from these different points? Supposing you had shafts down, wouldn't it be easier to prospect for ores and find where these bodies are than by having shafts three thousand feet apart?

A. Of course it would be an advantage to have a shaft, and it is an advantage to have them at frequent intervals. I don't want to make any estimate upon supposition. It is impossible to say what advantage would arise one way or the other, I think. At least I am not prepared to say. There are a great many places on the lode where they don't want to prospect, and don't want a shaft.

Q. Why don't they want to prospect?

A. Because they know it is barren. They know it is barren, as things go, in the Bullion lode.

Q. How did they find it out?

A. By drifting from the shaft.

Q. They might have ore below it?

A. That is very true.

Q. Supposing they had the Bullion shaft connecting with the tunnel, wouldn't it facilitate their prospecting operations?

A. Well, I don't know. It is entirely hypothetical.

Q. You don't know whether it would facilitate prospecting operations?

A. Well, there are certain places where the miner understands perfectly well, by certain signs, whether there is a fair prospect of meeting with ore. There are certain kinds of rock they would not think of going into.

Q. When you went over there, what statements did they make to you about the Savage mine. Did they think they would find anything below?

A. Yes; I think their impression was they would find ore below.

Q. Did they think they would find ore very soon?

A. Yes, sir.

Q. What did you think about the Ophir mine. Did you think they were under the same impression, that they would find ore?

A. Yes; I think they are under the impression that they will find ore. There is no reason why they should not.

Q. Mr. Day states as follows, on page 28:

"But the most important question of all, in this connection, presents itself, and as yet is unanswered, Does ore in paying quantities exist in the Comstock at these great depths? Taking a practical and most hopeful view of this question that the facts thus far developed will warrant, I am compelled to say, there are grave doubts, notwithstanding Professor Richthofen came to the rescue, and assures us that by his scientific and theoretical vision he sees it, and there is no doubt but ore in paying quantities exists in the Comstock fissure, from the surface to untold depths. But gentlemen of his class have deceived us so often, that I am sorry to say, we miners have little faith in their scientific prognostications."

Here we have the statement of Mr. Day, that he don't believe that there is any ore below; and yet they are digging away at that shaft?

A. No; he does not say that. He says there are grave doubts.

Q. Yes; he says there are grave doubts. He is doubtful about finding ore. At that time they had not discovered the ore in the Savage mine. They may have better hopes now; I think it probable; but at that time they did not know anything about that. Mr. Requa states this, on page 39:

"How to get the ore from these deep levels is not the important question on the Comstock. To find the ore to hoist, that is where the insurmountable difficulty comes in. To solve that problem requires more brain, muscle, and money than all other operations along the vein put together. Show us the ore, even at the depth of 3,000 feet, and I will give you a pledge, sir, that we will never ask how we shall get this ore out."

Then he goes on to say, immediately after,

"In brief, the whole tunnel project is impracticable, unnecessary, and totally uncalled for, except as a drain."

In another place the same gentleman says:

"The proposed adit, known as the Sutro tunnel, is not now, and never will be, a necessity to the lode, either for prospecting purposes, ventilation, or for the economical handling of metal-bearing material, waste, or debris, or as a means of entry or exit for men to the various mines located on the Comstock."

And then he goes on, in a very elaborate way, to show why it is not. Why do these men pronounce the tunnel as entirely useless and impracticable, when they in the same breath tell us that there is no ore below? They say they haven't got any ore, and at the same time they tell us they have to pay a royalty. At the same time they tell us, also, they are not going to use the tunnel, but are going to hoist out the ore; then why do they object to having the tunnel made? Do you think, General Foster, the tunnel would be useful for prospecting the Comstock lode?

A. Yes, sir.

Q. I want to go back again to this method.

Mr. SUNDERLAND. I would like to have the General answer these questions as we go along.

Mr. SUTRO. I think he has had time to answer.

Mr. FOSTER. I think you said the superintendents there pretend that the tunnel would be of no benefit to the Comstock lode.

Mr. SUTRO. Will you answer that question, General?

A. I saw these men a great deal, and talked with them a great deal, and they were men of capacity, great intelligence, and experience, and I gave them credit for being entirely honest; and I am convinced that they really thought they were writing the truth in what they wrote to us. Mr. Requa, in particular, struck me as being a man of large experience and very reliable—of excellent judgment. He certainly would not put his name to paper to anything that

he would not believe himself. I give him credit for that. As to Captain Day, I think he also is an excellent man, of a great deal of experience, and he struck me, as he will strike any body, as being a very reliable man. I think that he is perfectly honest in what he says. He believes what he says.

Q. Well, do you think he left anything out?

A. There are a great many things he might have put in. He answered our questions. We asked them certain questions, and they answered them.

Q. Do you think these people are mechanics, who say it is cheaper to pump out water than to let it run out itself?

A. That is a different thing. That is another question.

Q. They may be perfectly honest, and they may not be good miners. They may not understand anything about it?

A. That is very true; but the impression those men gave me was, that they were reliable in their own sphere of business. What they state here is borne out mostly by the notes that I took at the time. I asked the question repeatedly about the hoisting up. They went through what it would cost them per ton. They were working about 1,200 feet down, and the almost universal reply was, "fifty cents a ton." I suppose it will cost more as they go down. The general statement made, as we went through the mines and talked with them confidentially, tallies very closely with what we have written here, when we wrote them afterwards, asking for their written statements upon general points.

Q. Do you think these people would have any fears of losing their situations if they would do anything contrary to the wishes of Mr. Sharon, the agent of the Bank of California?

A. Well, I would be very sorry to suppose that they were so utterly dependent upon employment as to do that, because some of those men are men of decided character. One of the owners of the mines that I talked with a great deal, I believe, has aspirations for the United States Senate, and I take it for granted he is a man of character.

Q. Well, people might have aspirations for the United States Senate, and still not be—

A. No; I give them credit for being fair men.

Q. Who is that gentleman you refer to, General?

Mr. SUNDERLAND. Mr. Jones, I believe. He is a man who is very antagonistic to both the Bank of California and Mr. Sharon.

Mr. SUTRO. Well, do you think, General, if any one of those superintendents favored the tunnel he would be discharged? if they would come out and advocate the tunnel?

The CHAIRMAN. I think, Mr. Sutro, that is simply a question of opinion. It has no relevancy whatever to the laws of investigation.

Mr. FOSTER. I can answer it, if you wish. I asked some of them if they were hostile to the tunnel, and I was told by one—I think by more than one—that, as far as they were concerned, they were not hostile to it.

The CHAIRMAN. To whom do you now refer?

Mr. FOSTER. I refer both to Colonel Requa and Captain Taylor, of the Yellow Jacket.

Mr. SUTRO. That they are not hostile to the tunnel?

Mr. FOSTER. I understood them to say distinctly, that they did not put themselves in antagonism to the tunnel at all; that they understood us to come there to seek information, and to get their opinions honestly, and they were pledged to give them, just as they did give them. They did not wish us to consider them of the party that were hostile to the tunnel at all; and Jones was the same way. I think Jones was a little more favorable, perhaps, than either of the others. He carefully considered and weighed the chances of the tunnel being a benefit to the country.

Mr. SUTRO. Do you know why Mr. Jones did not send his statement to you?

A. No. We expected an elaborate statement from him, but we did not get it.

Q. He had written one, in fact?

A. I don't know.

Q. He told me so. Why didn't he forward it?

A. I don't know.

Q. It was reported out there that his chance for the United States Senate would be slim if he did?

A. Well, I hope not. He is a very clever gentleman.

Q. I believe he is. We have never differed at all personally.

The CHAIRMAN. Bear this in mind, gentlemen, in this investigation, that we shall be a number of evenings in hearing it, and a still greater number in reading it, and a still greater number in digesting it; and, if we are to arrive at conclusions, I think we want very direct interrogatories. I know it is an interesting subject to the gentlemen appearing, but I don't know how the committee feel about it.

Mr. SUTRO. General, I would like to ask you, after having shown at what rate ore can be lowered down to the tunnel level and delivered to the mouth of the tunnel, what facilities would exist there for getting water, first from the tunnel itself, and secondly from the Carson river?

Mr. FOSTER. Do you mean at the mouth of the tunnel?

Mr. SUTRO. Yes, sir. What facilities exist there for procuring water for the purposes of giving power for milling ores?

A. Well, the only facility for power—the cheap facility—is the Carson river itself, which might be turned from its course and brought down to the mouth of the tunnel, giving a very considerable fall from that point down to the river. I have forgotten the exact distance, but it is given here.

Mr. SHOBER. What is the distance from the mouth of the tunnel to the river, General?

Mr. FOSTER. The distance is slight, in a direct line. It runs very near the mouth of the tunnel. I should think it is about a quarter of a mile down.

Mr. SUTRO. Probably a little over that, General?

Mr. FOSTER. It may be more than that. It may be a half.

Mr. SUTRO. Nearly a mile.

Mr. FOSTER. Is it?

Mr. SUTRO. About a mile; yes, sir.

Mr. FOSTER. It is a gradual descending line all the way. About four miles above the tunnel is a rocky gorge, where the water might be dammed, so as to retain all the water that comes down from the snows in the spring, all that falls into the basin of the Carson. It was supposed another dam could be constructed farther back, and above Carson, to aid this, and prevent a larger overflow of the valley; but to carry out these schemes involves the construction of these dams, and the construction of a sluice from these dams to the mouth of the tunnel. It also involves the extinguishment of the titles of the mill-owners to their water privileges, and that is an objection in the way. But there is no practical obstacle in the way other than that of the extinguishment of the rights that the mill owners have to the water power. In point of engineering, it can be done. There is no doubt about that in my mind. We did not make surveys so much as we would have made them, if this thing had come up prominently while we were there.

Mr. SUTRO. General, could that power be brought right to the mouth of the tunnel?

A. The water power?

Q. Yes, sir; the water power. Could those mills be erected right at the mouth of the tunnel?

A. Yes, sir.

Q. And do you see any difficulty of dumping the ore, which I believe we figure it costs twenty-five cents per ton to take from the mine and deliver at the mouth of the tunnel, directly into the mill?

A. No, sir.

Q. Well, according to the present mode, even under the figures given by these superintendents, it costs fifty-one cents to hoist the ore, and \$1.50 to transport it. The ore could be dropped right into the mills?

A. Yes, sir.

Q. Have you any idea how much it would cost to mill

ore down there, with big water power and extensive works?

A. No, sir. I could not say how much it might be cheapened.

Q. The Imperial company has given \$4.50. They have a water power. They charge now how much?

Mr. SUNDERLAND. The Imperial company has no water power.

Mr. SUTRO. They used to have. The Mill company have got their mill now. They used to have a water power—the Union Mill and Mining company has it now. Then it would be great economy, would it, General—

Mr. FOSTER. It costs now, according to their statements, \$12 a ton, including hauling.

Mr. SUTRO. That is what they pay for crushing?

A. For milling.

Q. That is what they pay for milling to these people who own those mills?

A. Yes, sir.

Q. Well, who own those mills?

A. Of course I cannot give the names. They are owned by different parties.

Q. Don't you think they charge as much as they can get?

A. They charge all they can get, of course.

Q. They get about \$12 a ton?

A. Twelve dollars a ton for milling and transporting.

Q. Well, would you consider it a great economy to have these mills constructed at the mouth of the tunnel, and have the ore dumped right into the mills, without further transportation?

A. It would be apt to cheapen it very much.

Mr. SUTRO. I would close with General Foster if Mr. Sunderland would want to proceed, or shall I keep on now?

Mr. CHAIRMAN. I should be glad, while I have in my mind the current of the examination, to ask some questions. General Foster, while listening to your replies, several questions, which I desire to propound, originated in

my mind. One is in regard to the matter of ventilation. Is not ventilation effected upon a horizontal plane, providing you have two adits or shafts, with a motive power, passing in one way and out another?

Mr. FOSTER. On a horizontal plane?

Q. On a horizontal plane; yes, sir?

A. You mean to sink two shafts?

Q. Supposing you had two parallel shafts, or one shaft divided by any partition whatever, and (in order to illustrate) a train entering and passing out, making a circuit, if you please, through two shafts, or through one divided by a partition in its center, would that not create a current, and consequent ventilation?

A. Yes, sir; any two shafts that are close together, and that can be connected below, will produce a current. It will go down one shaft and up the other.

Q. And although they may be upon a horizontal plane, the circulation is effected?

A. Yes, sir.

Q. And after all ventilation is the result of friction, just as light is?

A. Is the result of the motion of the air.

Q. Yes, as I say, the result of friction. Therefore, the comments made in the different reports relative to ventilation are not correct, so far as they theorize that ventilation may be effected mechanically, as required? In other words, you can determine the ventilation to any point in this shaft by obeying a certain organic law of nature?

A. Yes; but here is one thing to which I wish to call your attention: If you have two shafts, and connect them below, that produces a current of air in the most direct way, coming down one and up the other; but in drifting off in different directions to seek the ore, they have no currents of air at the ends of those drifts, which they call headings. When you get down there twelve, or thirteen, or fourteen hundred feet, the air gets to be up to 110° or 112° . At those headings you have to force air in by tubes,

so as to blow on the men at work there. That has to be forced in by machinery.

Q. You direct me to another inquiry, which I propose to make. Taking the example which you have given, if the shaft or hole you might bore from above into these drifts were connected with a pipe, or a series of pipes, in these recesses, and terminated there, would there not be ventilation?

A. No, sir, not a bit. There must be a down-cast and an up-cast to produce the current of air. It don't go to the headings at all. It has to be forced there by machinery—that is, a regular blower.

Q. I think, General, I have not made myself intelligible. If those pipes were connected and hermetically sealed with the bore, and carried to a point a variation from the perpendicular in the most remote recesses, and there have its opening, it would be precisely as though the opening were just beneath the perpendicular shaft, would it not? In other words, the curvature of the shaft would not affect the expansion of the air and the draft you might create, so long as there was no fault in it?

A. And you think the air would come down this pipe—

Q. No. I am imagining an opening from below. I am contemplating now that you are reaching the current of air that is introduced from this adit.

A. No. I don't think it would. The air don't suck into the drifts at all. I couldn't say in regard to that, because I had never tried the experiment; but I believe they told me invariably that they could not get any air with any of the connections they had made at the headings. They have winzes, connecting shafts, and everything of that kind. They have never been able to get the air out to the headings except by blowing.

Q. That is very true, because both their shafts are precisely the same thing. But supposing you had a horizontal adit, reaching to a given point, that was, say, 200 feet remote, or 500 feet from the perpendicular air-vent,

and connected by a tube or pipes, would not that effect a perfect ventilation in the recess, a tunnel in or not?

A. Yes. The circumstances would not change with the tunnel. The draught is down and upward.

Q. It would accomplish precisely the same result, would it not?

A. I could not say with regard to that. We went into two tunnels, where we went in below and it was connected above. When we are in the direct line of a drift the draught is so strong that it will blow our candles out, but when we come to go into drifts, off from the main line of those draughts, we find it excessively hot and not a breath air—stifling, absolutely—a little ways off from the line of draught; I do not think in some cases it was twenty feet off where we went, and there was not a breath of air, not a motion of wind—absolutely stifling with heat and want of motion. And I was told it was invariably the case, that the air sought the shortest and most direct channel, and that it did not effect a motion of the air in the confined spaces off to the right or left, spaces which are five feet wide and six or seven feet high; and in all mines they have blowers driven by machinery, which cost ten or twelve dollars a day, in addition to all their connections, just to carry air to the headings where the men work.

Q. Another point in connection with the matter of ventilation: Would not the precipitation of water down this drain from the upper water levels, if carried by pipes into the recesses and out, lower the temperature and add moisture to the air?

A. Water tanks to aid a current of air? It certainly would have a decided effect.

Q. We will imagine now that we have a tube connected with the bore. The water of the upper level is precipitated down this bore of drainage, and it is carried perpendicularly and horizontally and on an incline, as the drifts may require, and when it reaches a certain point it is allowed an opening: Would not the precipitation of the

water in there completely drain the mine and produce the same effect that a blower produces?

A. Where it completely fills the tube, it wouldn't.

Q. Wouldn't it create a large current of air?

A. Not unless you have an arrangement called a water-blast.

Q. Would not that be practicable?

A. I believe they tried it upon the mines and didn't find it succeed; they didn't find it economical. And I think that this blower which they get made in San Francisco, and almost all the mines get those blowers, is the most economical and the most effective. Of course it is matter of experience.

Q. My mind is not clear on that subject.

A. I don't think it would work quite as well as you think.

Q. General, what enters into the computation of the cost of reducing the low-grade ores? What enters into the sum total?

A. First, there is transportation to the mill, which averages all the way from zero to two or three or four dollars. It will average about \$1 50. Then there is the handling and throwing it into the stampers, and the general course of the milling. The ore goes through the stampers and the settlers, and then it is united with quicksilver, and then it is removed from the settlers and squeezed, and then it is refined, to drive off the quicksilver, which is afterwards saved. Then they get their ingot, which they send to the mint or sell. That is all the milling process. The ore runs from one machine to the other, and goes through this whole process in the same mill, which requires water, and water is a considerable item of expense out there, on account of its scarcity. They have to pay pretty high for it—water for the milling and water for the boilers of the engines, in case you use steam.

Q. They have to pay a royalty for the water?

A. O, yes, sir; they pay very high for water; they pay so much an inch.

Mr. SUTRO. How much do they pay for water?

A. I don't know, sir. The Crown Point—some of the mines sell the water that they pump out for \$500 a month. It is used in the boilers of other companies and in the mills too.

The CHAIRMAN. Then the cost of milling and the cost of water make up the chief expense?

A. With the wear and tear of machinery—yes, sir.

Q. And therefore it prevents ores of a lower grade than those which yield \$20 a ton being made profitable?

A. Yes, sir.

Q. What proportion do the low-grade ores bear to the richer ones in the excavations which you have examined?

A. I could not give the exact figures without some thought, but the quantity is very small, compared with the quantity of refuse rock—very small.

Q. That is in ores which would range from what?

A. From \$20 up. There are millions of tons of low-grade ores in there now, which could be taken out and worked with advantage, if they could work them cheaper.

Q. Then the chief value of the greater portion of the mineral wealth is not now utilized?

A. Yes, sir, I should say so.

Q. That is, the larger proportion of low-grade ores?

A. Yes, sir.

Q. Is it possible for any human mind to contemplate the extent of that wealth?

A. No, sir; it is not.

Q. Even from the explorations already made?

A. There is an immense fissure-vein extending for miles, varying in width from 22 or 23 feet up to 500, and extending down to unknown depths. It may extend for miles in either direction from where it has been explored.

Q. From where it crops out?

A. Yes, sir; there may be parallel veins which may prove very rich. The workings thus far have only extended down to about 1,500 feet.

Mr. SUNDERLAND. It is more than that. When you say

1,500 feet, do you measure from the Gould and Curry croppings down?

A. From the top of the shaft. They are deeper than that in the Gould and Curry. They can work down as far as 4,000 feet; that is, it is supposed that they can, with the increase in temperature; as you go down, of about 1° in 55 feet. That, however, becomes a little less as you go very far down, one degree in 51 or 53. When you get to 4,000 feet it will become too hot to work; so they estimate that they can go down 4,000 feet. At that depth you get unknown values of ore.

The CHAIRMAN. They have not penetrated the earth to the depth of 4,000 feet in the Comstock lode?

A. No, sir.

Q. Therefore, it is merely by comparison?

A. Yes, sir.

Q. Then it is your opinion that the richness of the lode may continue and perhaps increase at the greater depth?

A. Yes, sir.

Q. Resulting from a dynamical disturbance; and the lode becoming more fixed and compact as you descend, and less liable to any solution, or action by the acids upon the surface, or the water, of course it would have greater solidity, would it not?

A. Well, there are a great many different views about that, whether this ore has been deposited by chemical agency, or by being thrust up, violently ejected, from below, or sublimated. You cannot tell exactly how that is. We only know that it is there. We only know that three of the richest bonanzas have been discovered very low down; one while we were there, one afterwards, and one now. Crown Point was discovered, which they estimate to be worth \$15,000,000, the rich body which they call bonanza. The Belcher has since discovered the same body running into their mine, which, I believe, they estimate worth about as much. And now the Savage, which at that time was working under difficulties, and was supposed to contain no ore, have discovered a rich body, so

that all the indications point to the opinion which I entertain.

Q. Then, in a geological point of view, as a question of national importance, to determine the richness of the mines, and to pursue a systematic method by which that can be attained, and cut off those experiments that are making in a fugitive manner, owing to limited capital, lack of experience, organizations fraught with jealousies, and perhaps a lack of skilled labor, would it not be of very great advantage to the country and to the world, as a scientific question, to determine the richness of those lodes at a great depth at the national expense?

A. Well, our opinion was unanimous that the value of this work as a prospecting work was beyond question, as far as we were concerned. Whether it is of sufficient national importance to justify its being carried on for that purpose alone we did not pretend to judge.

Q. As, a national question, a geological stand-point, to determine the wealth of the country in that mineral deposit, whether it wouldn't justify a very large expenditure on the part of the Government?

A. I think it would in a certain way, in the best way; but what that best way is, perhaps, would be the source of a great deal of controversy. I think the interests out there could be very well protected and furthered by the General Government, as it is the national interest. Whether this work, as a prospecting work, could be carried on at the expense to be involved, is a very serious question. There are some things that the Government could do, and could do well properly: as, for instance, the establishment of large reduction works for the reducing of ores at a cheap rate, so that the different mines all along the national transit can send their ores to them, instead of having to send them to England to be reduced. They send now from Utah to Swansea. Now, if the Government could construct government works to enable the miners to have ores reduced as cheaply as they can abroad, (might not be as cheap, because labor would be higher, but cheaper than now)——

Q. Well, they would have transportation in their favor?

A. Yes, that would advance the national interest of mining very much.

Q. Isn't water the cheapest power?

A. Yes, sir.

Q. Used in connection with this reduction?

A. Yes, sir.

Q. Is there not in the volume of the Carson river, with the artificial improvements suggested by you in your former remarks, sufficient to justify the establishment of works there upon a large scale, that might economically effect the reduction of those low-grade ores?

A. I think there is water enough there to reduce the ores of the Comstock. I wouldn't undertake to say that there would be enough there to run a large establishment for a national work, although one might be established there, and, if necessary, branches might be established upon other streams where there was sufficient power, and still be on the line of the railroad. This one might be made the parent and the others might be made the branches. But there is water enough on the line of the railroads to answer all the purposes.

Q. Well, now, General, supposing it were possible, through economical arrangements and appliances, for the reduction of the low-grade ores, to work both the low-grade ores and high-grade ores, would it be possible, with the present conveniences of those shafts, to elevate both those ores at the same time economically? In other words, if they removed both the low-grade and high-grade ores with their present means of access to the drifts?

A. It would cost nearly as much to get out the low-grade ores as it would the high-grade ores.

Q. Then, might there not be an economy in removing those by a cheaper mode of exit, even supposing it profitable to raise the high-grade ores by the present method, even with the supposition that they might raise the high-grade ores by the present means, presuming they have the works established, and all the appliances and facilities for

their reduction, but without the ability to reduce the low-grade ores?

A. Well, I hardly know how to reply. The great mass of the low-grade ores is near the surface, comparatively speaking. They can get them out a little cheaper than they can those lower down in these richer deposits. It would cost just about as much, though, to get them out—\$8 a ton—at the present prices. Whether that can be cheapened or not, I wouldn't undertake to say. The price of labor is kept up, as you know, by miners' unions, to four dollars a day in gold, and probably would not be reduced, and any effort to reduce it would meet with sturdy opposition. The only reduction in cost can be made by different modes of getting the ore out, and different machinery. I do not see the way clear for much reduction there.

Q. In putting my question, General, I had that in view. I took the basis of your calculation as to the means of removing the ore from the mines through this adit and the mouth of the tunnel. I had also in view your opinion as to the facility with which it could be reduced by water-power, and the economy with which it could be reduced. It appeared to me there was a very large reduction.

A. I think there could be a very large reduction made in reducing the ores.

Q. In the mechanical process?

A. After they are mined and got out. But I do not see, candidly, that the tunnel will much cheapen the getting of the ores out; that is to say, I think it will cost just about as much, and perhaps a trifle more, to run them out to the mouth of the tunnel by the method proposed; just as much, if not a little more, than to hoist up to the surface by the present machinery. Then you have got the comparison to be made, that from your shafts you have got to carry the ores to the mills, but you must recollect that that is down hill. In the other case you have got to pay a royalty, which just about offsets the advantage. As far as the mine-owners are concerned, they have got to pay so much money; then, unless you can very much cheapen the re-

duction of the ore and the getting it to the mill, you would have no profit whatever. You must do that largely or make no money. We were not able to report upon that, because we could not find the proper reduction machinery suitable to the locality.

Q. Supposing that no other result was attained in the penetration of the mountain, the investigation of the lode in a geological point of view, than to determine the richness of the ore at that depth, and afford facilities for getting at a greater depth, equal perhaps to 5,000 feet, would that not justify an expenditure on the part of the Government of an amount equal to that that would be required to construct this tunnel, having in view the immense mineral wealth supposed to exist in that region?

A. I could hardly answer that. That is a thing that I think you will have to judge of. I could hardly say that. I haven't the slightest doubt that it would be of very great value as an exploring work, and on all those points you refer to. This tunnel will strike all the different lodes in succession as they go out, and the drifting off will be easy, the prospecting will be easy. It will be of great value, but with me the estimation that must be put upon it is a difficult one to make. I could hardly attempt to do it; and as for going down below the tunnel level, when the tunnel shall have been completed, the going below that level will cost just as much, in my opinion, with our means of getting ore out, as the other; that is to say, in either case you have got to establish, on that basis, a new hoisting arrangement, and the going down below, in either case, will be by new hoisting apparatus, extending all about that level. If the tunnel is there, all the engines will be placed on that level of course. If the tunnel is not there, a good many of the mines will go down a thousand feet farther before they establish their new hoisting station. Some of them intend to go 2,500 feet, and some 3,000 feet—the most of them 2,500 feet. But if the tunnel is to go on, they will all have to establish their new basis on the level of the tunnel, which

will be two or three hundred feet farther than the deepest mines they have got down now.

Q. But, of course, every additional hundred feet involves a loss of time and increased wear and tear of the machinery. It would double the loss of time, of course, in going 2,000 feet farther, and increase the expense of ventilation?

A. Yes.

Q. As well as increase the expense of raising the material?

A. Well, I think, going from the tunnel level down, every item will about offset the one case with the other. If you hoist up to the tunnel level, you deliver it into the cars; in the other case you deliver it into a dump. Which is cheaper, to send it up the shaft or send it out the tunnel? The ventilation below will have to be forced; you will have to force the air down from that point just the same as though you were working from a new surface. The hoisting up will be just the same; the pumping will be just the same; everything will be precisely the same. The comparison can only be made, then, for the ore which is above the tunnel level; there is where the economy is to be obtained, if anywhere. I think, in going below, the expense in either case would be about the same. The difference in pumping would be merely to raise the water from the tunnel level up; in case of the tunnel, to discharge it out through the tunnel.

Q. You are impressed, from the statements made to you by the experienced miners and practical operators, that it is a true fissure vein, and that it is possible to continue to great depths?

A. Well, a good many of these mining superintendents had very little fixed opinion about the matter. They didn't reason about it much. When they came to an ore bonanza, they knew it was a true fissure down as far as that. They didn't speculate upon it much. I do not think they have the highest estimation of scientific men as a general thing, because they have been deceived out there, and they have had scientific men testifying before courts in direct

opposition to each other, and all that sort of thing. They are rather practical in their ideas. Some believe that it is a true fissure vein, and others do not. I do not think they have very fixed opinions upon it one way or the other, and we made up our opinion from what we saw and what we could see, and from what we could get from them, looking at the whole subject in its broadest bearings, with all the light before us; and we one and all thought the same way precisely.

MR. SUNDERLAND. There are two or three questions I would like to ask, in order to remove some impressions that may have been made here.

MR. SUTRO. If I ask two or three questions more, how much time do you think you will require?

MR. SUNDERLAND. If it is desirable for the committee to adjourn now, and wait until the next meeting, I am willing. I think the chairman seems to be under some erroneous impressions about the manner of working the mines. That is all I want to show just now. Or, I can do it at another time.

MR. SUTRO. I want to ask you, General Foster, whether you know how much timber there is consumed in the Comstock lode in a year?

MR. FOSTER. No, sir; except by the reports.

Q. I find a statement here, in 1867, in J. Ross Browne's Report, who was commissioner on mineral statistics then, that they consumed 17,910,000 feet per annum; and it has been stated in other places at 16,000,000 feet, which would be a pretty safe figure to take.

MR. SUNDERLAND. The consumption of timber depends upon the ore—bodies found. In some cases there is very little timber; in large bodies they use whole forests.

MR. SUTRO. That is the general estimate; but taking that 16,000,000 of feet, which would make in ten years 160,000,000, and at \$22 a thousand it would be \$354,000 a year spent for timbers that go down in the mines. That would be in ten years \$3,400,000, that they have expended for timbers that are now in the mines. How long do these

timbers last, with poor ventilation? Do you know, General?

Mr. FOSTER. No, sir, I do not.

Q. Do you know whether there is a difference between having good ventilation and poor ventilation as to the durability of timbers?

A. Oh, yes; there is a very great difference.

Q. What do you think is the difference, supposing the poor ventilation timbers last two years? With thoroughly good ventilation, how long do you think they might last?

A. They ought to last thirty.

Q. And supposing those mines in the Comstock lode were thoroughly ventilated, would it be an immense saving in replacing these rotten timbers?

A. Yes, sir.

Q. Supposing we take three years' timbers, leaving out what was put in previous to that. Three years' timbers would amount to a million of dollars?

A. Yes, sir.

Q. And supposing, instead of lasting two years, they could be made to last three or four times as long—anyhow it would be a saving of some hundreds of thousands of dollars a year, would it not?

A. It would, upon your supposition; yes.

Q. Yes; upon the supposition that you ventilate the mines thoroughly. It is said here there are 3,000 miners there: I don't know whether that is correct or not. But supposing there are 3,000 miners there, employed at the rate of \$4 each a day, that is \$12,000 a day in wages?

A. Yes. There are not as many miners as that.

Q. I don't suppose there are.

A. There are not over 2,000 of them.

Q. Probably not over 2,000. But they have all been figuring upon 3,000, and I take that as the basis of my calculations. I find it stated here that it costs from four to five times as much to make drifts with the thermometer as high as 110° as it would with an ordinary atmosphere, say of 75° or 80°. According to that, a man only does about

from 20 to 25 per cent. of the work he could do in a cool atmosphere?

A. It would appear so from that.

Q. Taking all the mines together, the drifts, etc., right through, what do you think would be the average increase in the capacity of the men for doing their work if the ventilation were perfect?

A. As compared with a temperature of 110° ?

Q. No, sir; not with a temperature of 110° , but as it exists now, which is stated to be from 90° to 110° ?

A. Between the present condition and perfect ventilation?

Q. Or, to put my question more clearly, supposing the thermometer were reduced to 75° instead of being from 90° to 110° as it is now, how much percentage additional would you get in labor out of the men? Give us your opinion—a general idea?

A. Well, it would be merely a guess.

Q. Should you think they would do two-thirds as much work at this high temperature as they would with a low one?

A. I don't think they would do half as much.

Q. You don't think they would do half?

A. No.

Q. Well, suppose it is 50 per cent.—

A. But I don't think it is possible to get perfect ventilation in the mines at all.

Q. But suppose they are pretty thoroughly ventilated. Suppose, for instance, there were 25 or 30 shafts down the Comstock lode, and all connected, don't you think the heat would be very much reduced?

A. I do not see how it could be. There is a certain law governing the heat, as you go down into the earth.

Q. Yes. But would not a current of air going constantly through 25 or 30 shafts gradually reduce the atmosphere to an ordinary temperature?

A. No, sir; it would not be possible. The heat would be higher down in the earth than it is on the surface.

Q. Supposing, however, that these drifts were open, and would remain open, and were ventilated as thoroughly as I stated, wouldn't the temperature gradually become reduced above the tunnel level, supposing each one of these 25 or 30 shafts to be connected with the tunnel?

A. It would not be.

Q. But that is the experience in other mines?

A. Take two shafts, going down side by side, and the up-cast air in one comes up as hot as steam.

Q. Yes, it does now. But supposing the connections made between all the different mines, and remaining open some time, say a whole year, with perfect currents of air going through?

A. I don't think you could ever get over the effect of the heat.

Q. You don't think the heat would be reduced at all?

A. Unless you upset the law of nature, in regard to the increase of the heat as you go towards the center of the earth.

Q. I am not speaking of getting below the tunnel level. I mean if you connect these shafts above the tunnel with the tunnel, and leave them open, with perfect currents of air passing through them all the time, do you think the temperature would be reduced.

A. It might be reduced.

Q. That is exactly what I wanted to get at.

A. I understood you to want me to admit that it would be reduced to that on the surface.

Q. No, sir. If the temperature were 110° , as it stands now, and currents of air were going up one shaft and down another, and through the tunnel and out the shafts, do you think that that temperature of 110° would be reduced to some extent?

A. It would be, to some extent.

Q. Well, to what extent, do you think?

A. That is impossible for me to say.

Q. What is your idea of it, after twelve months of this perfect connection?

A. Well, I am a Yankee, but I am not very good at guessing.

Q. Have you any opinion about it at all; do you think it would go down to 80° from 110°?

A. It is no use for me to hazard a conjecture.

Q. Let us suppose, without your answering the question, that it would go down to 80°, and the capacity of the men would be increased 25 per cent., do you think that is within the scope of possibility?

A. Oh, yes; certainly.

Q. Well, then, that would give an additional capacity of men of \$3,000 a day. Three thousand miners, at \$4 each a day, is \$12,000 a day, and if we get 25 per cent. additional labor, we get \$3,000 a day. You get now but 75 per cent. of the labor capacity; with this ventilation perfect you would save 25 per cent., or \$3,000 a day. That's an enormous item—a very large item. That is all I wanted to call your attention to.

Mr. SUNDERLAND. General, I would like to ask you a single question, and I won't ask but one. At the present rate of sinking the shafts upon the Comstock, keeping in view the difference between the level of the top of the shafts and the Gould and Curry croppings, from which point down to the tunnel it measures so many feet, won't all the principal shafts be below the level of the tunnel before the tunnel can be constructed?

A. Yes, sir.

Mr. SUNDERLAND. That is all I will ask now.

Mr. SUTRO. May I be permitted to ask another question? Won't a tunnel open a new basis of operations at a depth of 2,000 feet?

Mr. FOSTER. Yes, sir.

Q. Is there anything known about the Comstock lode below that depth of 2,000 feet? Has any body ever seen anything below it?

A. No, sir.

Q. Is it not a virgin vein? Nobody has ever known anything about it below there.

Mr. SUNDERLAND. Well, everybody knows that.

Mr. FOSTER. I don't know about its being a virgin vein.

Mr. SUTRO. Well, it would open a new basis of operations at 2,000 feet?

Mr. FOSTER. Yes, sir.

Mr. SUNDERLAND. I simply wish to show, Mr. Chairman, that this speculation of drainage and ventilation above the level of the tunnel is wholly unnecessary, because, before the tunnel can get to these shafts, they will all be down, and the mines all worked out below the level of the tunnel.

HEARING ON TUESDAY EVENING, FEB. 20.

Mr. SUNDERLAND. Mr. Sutro, I believe you are through with Gen. Foster, are you not?

Mr. SUTRO. Mr. Chairman, I would say that I would like to ask a few more questions of Gen. Foster when Mr. Sunderland shall have finished. There are some points that I skipped over. I will reserve my questions.

Mr. SUNDERLAND. If any questions have been omitted I would prefer having them asked now, so as to make mine a cross-examination.

The CHAIRMAN. I suppose, Mr. Sutro, you had better go on.

Mr. KENDALL. I suppose Mr. Sutro has got a right to make a re-cross-examination?

Mr. SUNDERLAND. No, sir; I think not. If he has omitted any questions, let him ask them now, with reference to those points which he forgot.

Mr. SUTRO. Very well. I find here, Gen. Foster, in the statement made by Mr. Graves, the superintendent of the Imperial mine, in answer to question number 7, on page 43, he says:

"The cost of raising the water for the past year is difficult to get at. Not having any pumps, it was raised to the surface with a tank, which we run only when absolutely necessary."

When you were over there, General Foster, did you visit the Imperial mine?

Mr. FOSTER. Yes.

Q. Did you see them hoist water there?

A. I did not.

Q. Did you see them raise water in a tank anywhere?

A. No; they were not raising water when I was there.

Q. Do you know that there is any difference between the raising of water by a tank and by a pump?

A. I should think it was a slower process.

Mr. SESSIONS. I did not understand the answer.

Mr. FOSTER. It is a slower process. They lower a tank,

just as you would lower a bucket into the well, and then raise it up by means of machinery, the same as you would raise a bucket out of a well.

Mr. SUTRO. If you have a given quantity of water to raise out of a mine, you have to exert a certain force. Does it make any material difference whether you pump it by a pump or hoist it out by a tank?

Mr. FOSTER. Well, of course it makes a material difference. One process is much slower than the other, and requires a greater expenditure of power.

Q. How much do you think is the difference in power?

A. Just one-half.

Q. One-half?

A. I believe that's it. In pumping, the pump-rod is made to act as an aid in forcing the water up. The whole weight of the pump-rod is exerted to force the water upward; and then to move the rod in the opposite direction they have a balance-bob; so that the total expenditure of power is much less than would be required if the water were raised directly by the power that is applied.

Q. How much friction is there in the pipes—say, for instance, if you raise water a thousand feet. There is a certain friction takes place of the water against the sides of the pipe; do you know how much that amounts to in pumping?

A. I haven't my books of reference, and I do not recollect.

Q. In hoisting water in tanks there is no friction. You simply hoist. There is no such friction as I have described in the pipes. There is no friction as in the pipes?

A. No friction as in pipes.

Q. Wouldn't that nearly counterbalance the difference in the power expended?

A. I cannot say with regard to that.

Q. Well, to lift a given quantity of water, for every foot it takes so much hoisting-power. I believe the rule is that a power that will hoist 33,000 pounds a foot high in one minute is accounted one-horse power?

A. Yes.

Q. Well, that power you get at the engine. Now, if you pump water in pipes, certain friction takes place, and you lose a certain amount of power. You don't get that horsepower which you apply, under the rule I have just given, at the engine. You do not get that full power in raising water, while if you raise water in a tank no such friction takes place at all. You couldn't give us any figure on making a fair comparison between the two?

A. Not immediately. I could in a short time.

Q. Yes, I suppose so. It is one of those questions, merely, where you take certain established rules into consideration?

A. I should look to the force required by a given description of machinery.

Q. I find that Captain Day states, on page 30, (I have before touched upon that subject, but was interrupted by General BANKS,) that the

"present flow of water, September 10, 1871, is 5 inches. Decrease in amount of water at 700-foot level, from June, 1870, to date, 72.23 per cent."

Do they find as much water when they sink down outside of the lode as when they cut the lode, General?

A. Well, I don't know that I can answer that from my acquaintance with the history of mining in the Comstock lode. It depends upon which side of the lode you sink your shaft. If you sink it in the east-country rock, I should think you would be nearly as liable to meet with water as in the lode itself, although I cannot say absolutely whether that is so. The east-country rock is porphyritic and is seamy; but in the west-country rock, being of a hard, granitic formation, very little water would be encountered.

Q. How do you account for the fact, General, that when they make drifts from these shafts and cut a vein, they strike large bodies of water after cutting the clay which encases the vein?

A. Well, that has been explained in this way: the clay seems, as it were, to form bowls or reservoirs of water, and when these reservoirs are tapped or penetrated, of course

the water all runs out; the bowl empties itself. When that is pumped out, there is no more water in the mine until you reach another reservoir.

Q. Do you know of any such reservoirs of note in the east-country rock?

A. Well, as I said before, my acquaintance with the mining of shafts in the east-country rock is very limited, but I can see no reason why it should not occur there in a similar way. I believe in one shaft that was sunk in the Monte Christo lode they were obliged to abandon work in consequence of the large amount of water they met with pretty near the surface. That is east of the Comstock. You might call that the east-country rock.

Q. Is it as likely that they will cut into large bodies of water in the east-country rock as it is that they would in cutting the lode?

A. Well, I am hardly prepared, as I said, to give a definite answer to that question; but I should think they would be nearly as likely to meet with it—not quite so much so, perhaps, on account of the looser character of the rock in the vein.

Q. Do you know anything about the history of mining down the Comstock lode during the last six or eight years: about the quantities of water they strike in cutting the vein?

A. Nothing except what was related to us.

Q. Who related to you what you know?

A. Well, it is very hard to tell that.

Q. What is the principal source of information that you had about this water?

A. We sought information from everybody at Virginia City. We sought it from the mining superintendents and from the mine owners. We sought it from the miners themselves always.

Q. Do you mean the laboring miners?

A. Yes, the laboring miners in the mines. We sought it also from the inhabitants of Virginia City. We sought

it from every person, in fact, so that we might be sure we were getting pretty near the truth.

Q. Do you think there is likely to be as much water found outside of a lode as in cutting into the vein?

A. I don't say that. I say that you may meet with it outside as well as in the vein.

Q. In what proportion would that probably be?

A. Well, it would be a mere guess for me to answer that question. I don't see that you could expect me to answer a question of that kind.

Q. Mr. Day states that the water has decreased from 18 inches to 5 inches, when they had 18 inches the year before. Do you know what they were doing then at that shaft?

A. They were sinking the shaft.

Q. The year previous?

A. Let me see. I don't know. They were sinking the shaft; yes, sir.

Q. But were they not drifting the year before?

A. Well, I can't say whether they were or not.

Q. He speaks about the 700-foot level in here, where they have been drifting from?

A. Yes, he speaks of it. Yes, I know. But you asked me the question, and I couldn't answer it myself, from my own knowledge.

Q. Well, supposing we take this five inches of water; do you know how much that is?

A. Five inches is five-inches flow, in a certain head, miner's measurement.

Q. Six-inch head?

A. Yes, sir; and 6 inches pressure; that's the miner's measurement.

Q. Mr. Day states, on page 27:

"This is a dry country, and all who have looked upon it know it."

Well, he gives five inches here, on September 10, 1871. That's after they had been pumping for several years, and it had decreased from 18 inches to 5?

A. Do you mean to refer back—

Mr. SUNDERLAND. Not several years, Mr. Sutro; just one year. That's the statement.

Mr. SUTRO. They had been pumping, I say, for several years.

Mr. SUNDERLAND. The statement he gives is only one year.

Mr. SUTRO. He only gives the statement for that one year.

Mr. FOSTER. Is it from June, 1870, to June, 1871?

Mr. SUTRO. Do you know how much a gallon of water weighs, General?

A. No; I cannot tell.

Q. Well, it weighs 8 $\frac{34}{100}$ pounds, an imperial gallon?

A. I say I don't know. I am not prepared at this moment to give it. I have, of course, the tables of all those things.

Q. Do you know how much a miner's inch will discharge in a minute?

A. No, sir.

Q. Well, the rule is 17 $\frac{4}{10}$ gallons?

Mr. SUNDERLAND. I object to the testimony given by Mr. Sutro, if the chairman please. I don't know anything about these tables. They may be right, and they may be wrong.

Mr. SUTRO. This is a matter of statistics. It is a well-known fact. Every book on mining will show it—how much water will be discharged under a six-inch pressure. It is a rule well-known to all miners.

The CHAIRMAN. It will appear in the minutes of the remarks of Mr. Sutro.

Mr. KENDALL. As I understand it, Mr. Chairman, these preliminary observations of Mr. Sutro are made as the basis of further questions?

Mr. SUTRO. That is the idea. I want to arrive at a question here, and, in order to do that, I have to define what I am going to ask.

Mr. CHAIRMAN. The committee are not obliged to be too particular.

Mr. SUTRO. It is stated that $17\frac{4}{10}$ gallons are discharged—the miner's inch—per minute. There are $17\frac{4}{10}$ gallons per minute discharged to a miner's inch. Mr. Day gives us five inches. That gives us 87 gallons per minute, under his statement, or 5,220 gallons per hour, or in 24 hours 125,280 gallons, of $8\frac{34}{100}$ pounds each, which gives us 944,835 pounds of water raised in 24 hours, or $472\frac{41}{100}$ tons. We have previously shown that they are hoisting 12 tons of rock out of the Ophir mine in every 24 hours; and these figures show, taking it for granted that it has been reduced to five inches, that, in order to get out that 12 tons of rock, they have to hoist out 472 tons of water. Do you think that is a considerable proportion, as compared to the quantity of rock they take out, General Foster?

A. Well, I am not prepared to say, in regard to that.

Q. Do you think, General Foster, that it is easy mining where you have to take out 472 tons of water from a depth of 1,200 feet, as it is stated here, in 24 hours, to get out twelve tons of rock. Do you think that is comparatively easy mining?

A. Well, I only know that they go through with it pretty easily. They conduct operations there with tolerable facility.

Q. Well, do you think they could mine much easier if that 472 tons of water was let out below, and they had simply to hoist twelve tons of rock?

A. Yes; undoubtedly.

Q. Do you think it would be any saving to the mine?

A. If the water were let out below free of expense, or for a less sum of money than it would cost them to pump, I think it would be a saving to the mine.

Q. Would the Ophir company have had anything to pay while they were taking out no ore?

A. Under what circumstances?

Q. During the time they had been sinking this shaft?

A. You mean under your contract under the law.

Q. I simply ask whether the Ophir company would have

been placed in advantageous circumstances concerning this water, if they had been allowed to run that water out through the tunnel for nothing?

A. Of course they would have been under very advantageous circumstances.

Q. What percentage do you think they would have saved in mining if they had saved the hoisting of 472 tons of water, in order to get out 12 tons of rock?

A. Well, they would have saved just what it cost to pump it.

Q. Well, you think it costs about as much to pump a ton of water as it would to hoist a ton?

A. Well, we know what they state to be the exact expense of pumping. We know what it costs other mines to pump.

Q. Mr. Day states it cost \$29,317, for the year previous, to pump?

A. What page is that on?

Q. Page 30.

A. What is the question?

Q. I have stated that Mr. Day says it has cost them \$29,317 04 to pump for the year previous?

A. Yes.

Q. And I have heretofore shown that they have taken out on an average twelve tons of rock a day. Now, if you figure 472 tons of water a day at hoisting prices, how much would that come to?

A. Do you want me to make the figures.

Q. Could you give us an approximate idea?

A. No, sir; not without figures. What is the problem?

Q. It costs \$283 a day, at your estimate of 51 cents a ton.

A. How many tons are there?

Q. Four hundred and seventy-two tons of water.

A. How much do you say it costs?

Q. I say it is \$283.

A. I make it \$240, taking 51 cents as the cost per ton.

Q. I make it \$283, at 51 cents.

A. I left off the decimals, taking 51 cents. I make it \$240 72.

Mr. SUNDERLAND. That is the cost if hoisted on a cage?

Mr. FOSTER. Hoisted in the way they raise the ore; yes, sir.

Mr. SUNDERLAND. They don't raise it that way, I believe.

Mr. SUTRO. Two hundred and forty dollars. Yes, sir; you are right. That makes \$7,200 a month, at that rate.

Mr. FOSTER. That would be the cost of hoisting, in the same way that you hoist ore.

Mr. SUTRO. Or \$86,400 per annum!

Mr. FOSTER. Which explains more fully what I was endeavoring to explain a little while ago, in answer to your question. It would cost more to raise it in that way.

Mr. SUTRO. How do you arrive at that? Do you arrive at it by reason of these figures given by Captain Day?

A. These figures show what I was endeavoring to explain in regard to hoisting by the—

Q. Provided his figures are correct. You take it for granted that all these things are correct as they were given you?

A. Comparing these figures with what was given in his report—

Q. Yes, but then they don't make the right figures, General, you see. We have figured on five inches, which he says it had decreased to on September 10. But he says in June it was eighteen inches, and July sixteen inches, and so on down to ten inches; consequently, we have not given the right figures quite yet.

Mr. SUNDERLAND. He states what the actual cost is.

Mr. SUTRO. Well, I don't take the statements of these gentlemen for granted at all.

Mr. SUNDERLAND. Well, I do.

Mr. SUTRO. The average is $10\frac{66}{100}$ inches. That is more than double what we have been figuring on; consequently it costs about \$200,000 a year to hoist out that water.

Mr. KENDALL. Five inches?

Mr. SUTRO. No. The cost of hoisting out the year pre-

vious amounts to almost \$200,000. How does that tally with his \$29,000, General Foster?

A. Ah, but you are supposing it to be hoisted out now.

Q. Yes, sir.

A. Well, hoisting would cost much more than pumping.

Q. How do you make that out? You have got to lift a given number of pounds; there are so many pounds to be lifted. I have shown here that there are 940,835 pounds to be lifted out every twenty-four hours, out of a depth, say of 2,000 feet, down to the tunnel level, or say 1,700 feet, to be more accurate. Allow 1,700 feet you have to lift that number of pounds, and every engineer knows that for every foot of raising 33,000 pounds per minute you have got to have a horse-power. If you get that out, you have got to have so many horse-powers.

A. It is a very different thing. One is hoisted altogether by machinery; the other takes the aid of men, and it is slow and intermittent; the pumping is constant.

Q. You have no friction in pumping, have you? The friction is given at 33 per cent., which is enormous.

A. You have the friction of the cage on its gauge, of course.

Q. Well, is there no friction of water?

A. I don't want to argue the question, but I believe it is an established fact, that you can pump much easier than you can raise water in vessels.

Q. Do you think, General Foster, that you can pump the same quantity of water for \$29,000 that it would cost \$200,000 to hoist out?

A. Well, if I should state that, you would make me responsible for these figures. I don't state that. I simply state that one process of raising water would be more expensive than the other.

Q. I will presume a case now. Supposing it costs \$29,000 to pump out a given quantity of water, will it cost \$200,000 to hoist out the same water from the same depth?

A. I am not prepared to say whether it would or not.

Mr. KENDALL. Mr. Chairman, let me ask General Foster,

directly, what is the difference of cost between hoisting water at that depth, say 2,000 or 1,700 feet, and pumping the same quantity?

A. Well, I can hardly give you the figures for that without calculation.

Q. Well, approximately?

A. I could not give it to you approximately. I can give you the figures in a very short time of what it would cost by both processes, let me take my tables and take the known capacity of pumps; but I would not like to answer a question of that kind by a mere guess. I can, by the next meeting, prepare a statement which will show you exactly what the difference would be. If you like, I will bring it and put it in as an answer.

Mr. SUTRO. Mr. Day states that, in June, 1870, they were pumping 18 miner's engines of water. This is equal, under our rule here, to 1,700 tons in 24 hours.

Mr. SUNDERLAND. If the General is going to examine his tables, I would like to have him answer that question, as to what it would weigh. I don't know whether Mr. Sutro is right about that.

Mr. SUTRO. What what would weigh?

Mr. SUNDERLAND. The five inches.

Mr. SUTRO. Well, if there is anything incorrect about that, it could be very easily established. There is nothing difficult about that at all.

Mr. SUNDERLAND. General Foster can do it.

Mr. SUTRO. I will read you the rule, if you want it.

Mr. SUNDERLAND. No, I want General Foster to examine it.

Mr. SUTRO. It is the rule taken from the Mining Journal of California.

"MINER'S INCH. A body of water 336 feet long and one inch square will pass through an orifice one inch square under a pressure of six inches, measured from the center of the orifice, per minute, or $148\frac{86}{100}$ lbs., or 17.4054 United States standard gallons, or 2,333 cubic feet."

That is the rule, sir, that every mining engineer will indorse. You have it then here, that, in June, 1870, Mr. Day states that he had 18 miner's inches of water, which

is equal to 1,700 tons and a fraction of over 24 lbs., and he calls that a dry country. Do you think, General Foster, that if that 1,700 tons of water had been let out by means of that tunnel, if that tunnel had been made, it would have saved any money to that company?

A. Certainly.

Q. They were hoisting at that time 12 tons of rock, and supposing that they could have hoisted that 12 tons of rock without being impeded with any water at all, don't you think that the cost of working that mine would have been but a trifle compared to what the real cost was?

A. The cost would have been less, undoubtedly.

Q. Well, that is the Ophir company. I might as well state here, that if we take the average of the whole year, eighteen inches, commencing with eighteen inches and ending with seven inches, we get a quantity of water amounting to 1,005 tons every 24 hours during that year; 1,005 tons, of 2,000 lbs. each, had to be lifted 1,700 feet in all to get out 12 tons of rock. Now, let us take the Gould and Curry company. On page 33 Mr. Batterman says:

"The capacity of the pumps is 6,500 gallons per hour. I estimate the cost of pumping from a depth of 2,000 feet, working pump to full capacity, at \$83 60 per day. This estimate includes wood, engineers, fireman, pitman, &c. From this estimate of cost should be deducted the value of the water."

Then he goes on to say, in reply to question No. 7:

"Cost for the year, \$16,425."

This is for pumping. Now, if we take 3,500 gallons, which he says he has been pumping per hour——

A. How much?

Q. Thirty-five hundred gallons per hour.

A. Sixty-five hundred?

Q. He says the capacity of the pump is 6,500 gallons. But he has been pumping 3,500 gallons. I take this gentleman's figures here now, and we get 84,000 gallons per day. At $8\frac{34}{100}$ pounds to the gallon, that gives us 700,560 pounds of water per day, which is equal to $350\frac{28}{100}$ tons. Do you think that is a pretty dry mine, General?

A. Well, it isn't so wet as some mines,

Q. Well, do you think it is as wet a mine as there is over there?

A. The Gould and Curry? No, O, no. The Savage, when we were there, was the wettest.

Q. We will recur to the Savage after a little. Here are 350 $\frac{28}{100}$ tons per day. Now, supposing there had been a connection with the tunnel, and that 350 tons of water had been let out at the bottom of the shaft, wouldn't that have been a big saving for that company?

A. It certainly would have been a saving equal to the cost of pumping it out.

Q. Supposing they were to have let it out for nothing?

A. They would have saved precisely what it cost to pump the water.

Q. Wasn't that the main expense of that mine, to pump out 350 tons of water a day?

A. No, sir.

Q. Wasn't it a large item of the expense?

A. Well, you see what the item is. It is given there.

Q. We have seen heretofore that the superintendent of the Gould and Curry company states that there is no ore below. We have also shown that he has made over 12,000 feet of drifts during the last year. They have simply been prospecting there. He also states that he don't suppose there will be any ore there in six months more. Now, wouldn't it have been a very advantageous thing to that company to have had that tunnel in, while they were making these prospecting drifts, 12,000 feet in a single year?

A. Well, as far as the drifts are concerned, I don't know that the tunnel would have been of much benefit to them.

Q. Haven't they got to pump while they make these drifts? Haven't they got to keep the mine clear every foot they make?

A. Of course they have to keep the mine clear.

Q. Wouldn't it fill up with water if they stopped pumping?

A. Yes, sir; it probably would. The lower part would.

Q. Well, supposing the mine had an outlet below,

wouldn't they have made those drifts without any expense of pumping at all?

A. Certainly.

Q. Now, taking these figures here as a basis, 350 tons at the Gould and Curry and 472 tons at the Ophir mine, that gives us an average of 411 tons between those two mines. What proportion of water do you estimate that that would be on the whole lode? Take the 22,000 feet; suppose it were all explored and the shafts down—411 tons at one shaft.

A. Do you mean what would be the proportion of the whole water that would be pumped from the lode?

Q. Supposing there were 33 shafts let down into the lode, as we supposed at our last meeting, how much do you think each shaft would average? We have the average of two shafts, viz, 411 tons.

A. Well, I don't like very well to average supposititious questions, which are so very indefinite. I will answer anything I am able to answer.

Q. Have you examined into this question of water?

A. Certainly; I examined into it.

Q. I suppose you are familiar with the quantity of water in the different mines?

A. You want, probably, by these questions, to make it appear that they have not made a proper return to us of the cost of pumping.

Q. I do, sir. That is exactly what I mean to show; what I mean to prove.

A. You can't prove it by me—by mere supposititious questions; because that is no proof at all. I can't answer those things.

Q. I want to find out whether it is possible to take out 472 tons of water per day at the price stated?

A. Well, that is a matter of investigation, and I am not prepared to state now in regard to it. I must decline to answer supposititious questions of a wild and indefinite character. If the committee want to know exactly what it has cost, and have such a statement from me what

the comparison would be, in addition to this report, I should be prepared to give it.

Q. General, how are we going to arrive at the correctness of these statements, when on the face of them they are not correct?

A. The way I should arrive at it would be to get somebody here who can testify directly to the truth or falsity of those statements. I don't think that any indefinite answers that can be given to supposititious questions would disprove them. I am no lawyer, but I should think they would not. I can't disprove those statements.

Q. You have taken in your reports, General, the statements of seven superintendents here?

A. Exactly.

Q. You made your report upon that basis, and you state it costs \$124,000 a year to pump.

A. Well.

Q. But I believe we can prove that it will cost more than that in one single mine, and there are thirty mines on the lode?

A. Very well.

Q. How are we going to get at these figures?

Mr. SUNDERLAND. Show it if you can.

Mr. SUTRO. You are an engineer, General Foster, and you are able to judge whether 472 tons of water can be hoisted or pumped out at the figures these people make.

Mr. FOSTER. You want me to answer these questions here now, and I am not prepared to do so. If the committee wants it, I can make the figures, and show what the relative amounts would be.

The CHAIRMAN. It would be more satisfactory if Mr. Sutro will put his inquiries in writing.

Mr. FOSTER. And I could bring the answers at the next meeting.

Mr. SUTRO. It would be impossible to arrive at that, except by a general statement, from general observation. My question is: If we have 472 tons of water every twenty-

four hours at one shaft, how much will it probably be at all the shafts? That is a reasonable question to make.

Mr. FOSTER. Well, it's very indefinite:

"How much will it probably be for all, if you have so much for one?"

Nothing is more uncertain than the striking of water, or the presence of water. You may have more water in the shaft of one mine than you have in all the others.

Q. Then we have two statements here. We have one from the Ophir mine, and one from the Gould and Curry mine. These are the only answers in your report of a definite character, and these are the only persons that have answered them definitely. Now, I mean to say, that these gentlemen have not stated the facts fully. They have not given the figures that would lead us to a correct idea of the quantity of water there. Now, how are we going to get at it, but by comparing the statements of these two mines, taking the whole length of the lode, and multiplying it by the number of mines outside of these two? I cannot see any other way to get at it. We want to get more definite results.

A. The proper way to get at the cost of pumping is, to take the elements into consideration: the cost of machinery, the cost of fuel, the wear and tear of the machinery, the interest on the investment, the number of men that are employed, the pitmen, engineers, etc., and to add these several items together: that will give the cost. That is the only way to get at it.

Mr. KENDALL. By your permission, Mr. Chairman, I will ask General Foster two or three questions that may add to the facts elicited by this examination. Did you examine these various mines, with reference to the quantity of water that is flowing into them—these seven mines?

A. Not particularly; no, sir. That was only one point of the investigation.

Q. Did you examine them sufficiently to arrive at a general opinion as to the average amount of water that was flowing into each of these mines?

A. Yes, sir.

Q. Now, then, here are seven mines. About what, General, was the average amount of water that came into these mines per day? Of course you cannot give it exactly; but give it approximately. Some are wetter than others. Some are, perhaps, nearly dry. Some are very wet. Now, about what would be the average amount?

A. Well, I cannot give an answer to that right off. Let me see. I saw one—I saw the Ophir, the Gould and Curry, the Savage, and the Crown Point pumping.

Q. Take the Ophir, General. I think you remarked that that was not so wet a mine as are many of the others?

A. I did not go down it myself.

Q. Well, from the information you derived, it was about the driest mine of the whole series you have mentioned. Was that the statement?

Mr. SUNDERLAND. No, sir; it was not.

Mr. FOSTER. It was the next wettest of the mines that I saw.

Mr. KENDALL. What was the driest mine, then?

A. I think the Yellow Jacket was as dry as any.

Q. Do you know the quantity that flowed into that mine, or about the quantity?

A. It was none at all. At least what little water did run into it ran into the Crown Point, and the Crown Point was pumping very little. They didn't pump enough to supply the boilers from both mines.

Mr. SUTRO. Just here, will you permit me to ask a question?

Mr. FOSTER. I could make a statement that would be very close to the amount they were pumping out while we were there. The Ophir mine was running their pump very slowly. The Savage was running their pumps very fast—as fast as they possibly could. I think I have notes in New York that will give exactly the number of gallons they were discharging; and if General Wright comes on he will bring those notes with him, so that we can tell you exactly on that point. But the expense of pumping is hardly dependent upon the quantity of water you get out.

They run the pumps, and if they only run about half the time, they have to keep their engines there and the men there; and there is the wear and tear of the machinery the same, and most of the other items of expense remain the same. Now, the Crown Point only ran their pumps very little—a very little—and they had to have the same kind of expensive machinery, and they had nearly the same men employed. The elements of expense were about the same.

Mr. SUTRO. General Foster, you have just stated that, when you were there, the water from the Yellow Jacket was discharging into the Crown Point?

A. It ran into the Crown Point.

Q. Consequently there was no water in the Yellow Jacket?

A. The water that was there was the seepage from above.

Q. Exactly. Now, how fair would you consider this answer, given by Mr. Taylor, the superintendent of the Yellow Jacket—

Mr. SUNDERLAND. What is the page?

Mr. SUTRO. Page 44, question No. 8:

"Has the water in your mine increased or diminished with the depth, and in what proportion?"

To this he replies:

"The water in the mine has decreased from 20 inches, at 250-foot level, to less than 1 inch at 1,130-foot level, (miners' measure, 6-inch pressure.)"

Do you consider that a fair answer to your question, when at that time the water was discharging into the Crown Point mine, and they had no pumping to do?

A. Yes, I consider that a fair answer.

Q. That's a fair answer to your question, whether the water had decreased in their mine or not, when he states that it had decreased from 20 inches to 1 inch, and a stream of water was running into the other mine adjoining it, and they were pumping it out! Do you consider that a fair answer to your question?

A. Yes; it was a very fair answer from what we understood. We knew that the water which came in there was only the seepage from above. It was a very small stream.

that ran from there to the Crown Point, and the Crown Point pumped it up, because they only had their own water to pump, and they had as lief pump that up as not.

Q. Well, in presenting this report to Congress, is it not intended to mislead them with regard to the quantity of water in the Yellow Jacket mine?

A. I don't think it is, but I will look at it again. Where is it?

Q. On page 44. Have you found it?

A. Yes, sir; I consider that perfectly fair. I believe that the amount of water that ran into the Crown Point mine from the Yellow Jacket was not over one inch; miners' measurement. It had to be pumped up by the Crown Point. I don't think it was over an inch. It was a very small stream.

Q. How do you know that?

A. I saw it. I saw it running in myself, and I saw them pump it out.

Q. How much lower was the Crown Point mine than the Yellow Jacket?

A. The Crown Point mine, I think, was down to about 1,500 feet when I was there, and the Yellow Jacket was at nearly the same depth.

Q. Have you had any experience in mining, General?

A. Well, yes; I have had as much experience as some other people have.

Q. Do you know—

A. If you ask the question seriously, though, I will answer it. I suppose you want to underrate my testimony by it. I answer candidly, I have not.

Q. I do not wish anything of the kind. I simply want to get at the idea whether, where one mine joins another, you are aware you cannot see the entire flow of water between them. The water comes underneath the rock.

Mr. SUNDERLAND. Were they not mining on the 1000-foot level when you were there?

Mr. FOSTER. I saw enough of mining to know about that fact. I saw the water running, and it was running, when

I saw it, in a drift. It came through from one mine to another. They were mining nearly on the same level. This was on the same level. It was running through, and it was running at about six feet a minute, which would make about 360 in an hour. It was running through a drift, connecting the two, from the Yellow Jacket into the Crown Point, and in the Crown Point it was pumped out just about an inch, I should say, miners' measurement.

Mr. SUTRO. Isn't the vein matter porous, General?

A. Yes, sir.

Q. Well, now, supposing there was a large quantity of water at the bottom of the Yellow Jacket mine, would it not seep through the rock, and find its way to the pumping sump in the Crown Point mine, provided that is lower, without flowing through a drift?

A. Well, I don't know about that. I only know that I saw water running from one mine into the other, and saw the other mine pumping it up.

Q. Well, now, I come back to the Gould and Curry mine, where we arrived at 350 tons in 24 hours. On page 33 of the commissioners' report, Mr. Batterman states, that it cost for the year \$16,425 to pump. Now, General Foster, do you believe that 350 tons every 24 hours can be pumped out of the Gould and Curry mine, from the 1,300-foot station, at a cost of \$16,000 in a year?

A. I believe that it is not pumped from that level.

Q. He states so.

A. Thirteen hundred-foot level?

Q. He says:

"The cost of raising the water in this mine from a depth of 825 feet, also running pumps while sinking to 1,300-foot station, has been \$60 per day, the quantity of water raised about 3,500 gallons per hour."

A. From the 1,300-foot station; yes.

Q. Now, I ask this again, General: Do you believe that 350 tons every 24 hours, which is equal to 3,500 gallons per hour, as he states, can be pumped out of that mine 1,300 feet for \$16,425 a year, including wear and tear of machinery?

A. He does not state that.

Q. Do you believe that that quantity of water can be pumped for \$16,425?

A. I believe that that statement is correct. I believe from a depth of 825 feet to 1,300 feet the cost of pumping was as he gives it.

Q. Did you enter the Savage mine while you were over there?

A. No, sir.

Q. Did you enter the Hale and Norcross?

A. No, sir.

Q. Why didn't you?

A. They had had an influx of water in both mines, first in the one mine and then in the other; and they were running their pumps, and everything was in a condition which made it very unfavorable for us to visit the mines.

Q. Were the men drowned out, so that they had to leave the mines?

A. The mines were considered to be flooded, and our suggestion to go into the mine was not met favorably by the parties in charge, who represented these inauspicious circumstances; and so much was said to discourage us, that we did not go.

Q. Did you make repeated applications to go?

A. I don't know that we made repeated applications.

Q. Did you express the desire?

A. We expressed a desire to go repeatedly.

Q. What do you think was the reason they wouldn't let you go in there?

A. I think the reason is just as they stated it, that the mine was flooded with water. They were pumping with their utmost energy, and everything was in too much disorder and confusion to visit the mine and find out anything. All we could have found out would have been how they were pumping, and what was the capacity of the pumps.

Q. What did you hear about that flood that had taken place there? Did you hear any particulars about it?

A. No particulars, except that the water burst in on

them, and flooded one mine, and then penetrated to the others.

Q. Did you hear anything of the mine getting filled with rock by the immense force of the water getting in, the drifts filling up with rocks and debris?

A. No, sir.

Q. You didn't hear of that? Did you hear that they had an immense influx of water there?

A. We heard that the mines were flooded.

Q. And you heard nothing about any drifts filling up at all?

A. I have already answered that we did not.

The CHAIRMAN. General Foster, this accumulation of water was in excess of the amount to be pumped out daily, was it?

A. Oh, yes, sir. They were getting it down as we were leaving, and they expected to have the mine in proper condition for inspection in a short time. I presume if we had insisted on it we could have inspected both mines.

Q. What is the capacity of the pumps they were using?

A. I did not examine them. I observe that the capacity of those pumps, as in fact all the machinery in use on the lode, is given in full in King's report, and we didn't find it necessary to take detailed notes upon that point, because we had that report at hand. The report is very elaborate, and gives the machinery of all the different mines.

Q. General Foster, you are, I believe, compelled to rely upon these reports, made by the superintendents of the Ophir and Gould and Curry mines, for the opinion you have expressed in your report as to the cost of pumping and lifting the ore?

A. Yes, sir.

Q. You had no other means of ascertaining?

A. We relied not only upon these, but upon the superintendents of the other mines also. Their testimony as to the cost of pumping and lifting was taken into consideration.

Q. You had no other means——

A. We had reports in full from six. We expected to get it from Crown Point, but he did not——

Q. You had no other means for ascertaining the accuracy of these reports than the opinion as to the reliability of the persons who made them?

A. None other, except our own opinion, on the testimony of other people.

Q. You didn't examine their books?

A. We did not; no, sir.

Q. You did not ascertain whether they had the number of men represented at work?

A. No, sir.

Q. You didn't take any notes as to the quantity of ore that they were raising in a given time, or the quantity of water?

A. We did the quantity of ore in one or two instances, and we also took notes of the quantity of water that was being discharged, and we had them in our note-books at the time we were visiting the mines. These note-books will be here in a few days.

Mr. SUTRO. General Foster, let me ask you whether you heard about a fire that took place one time in one of the Gold Hill mines, by which forty-five miners were burned to death?

A. Yes, sir; the fire in the Crown Point mine. An account of it is given in Clarence King's report.

Q. Supposing there had been an outlet below, after the mine had become filled with smoke, do you think these miners would have been burned to death?

A. I believe there was an outlet below then, and the fire got between them and that outlet, and that is the reason they were burned to death.

Q. The fire spread between two mines. How could there have been an outlet below?

A. There was an outlet between the one and the other, but the fire intercepted them. It might had there been a tunnel, but is not so likely.

Q. Supposing the tunnel were in, and the draught going

either way, could they not escape one way, where the draught was coming from?

A. Well, the escaping depends upon the position of the fire. If the fire should be below, they could come up. Probably, if the fire was above them, and they had a clear passage below, they could go out below.

Q. Supposing these mines were all connected at the bottom, with lateral drifts along the mines, and cross drifts?

A. But if the fire should shut off their egress in both directions they would be burned.

Q. Is that a probable case?

A. Well, that's the way the fire was in the Crown Point.

Q. Didn't it commence between the two mines?

A. I believe it did.

Q. There was no outlet; the shafts became filled with smoke; how could they get out?

A. But, my dear sir, a great many of them were hoisted out.

Q. Some few got out, but forty-five got burned to death.

A. They were suffocated by the gases, and they could not get out; they fell dead. There was an outlet for them.

Q. Well, I mean to say, supposing there were ramifications and connections all over, could they not have got out of the tunnel?

A. Well, they had the fairest outlet in the world; they had the direct shaft up to the open air.

Q. Wouldn't the smoke rise right up the moment the fire started, and fill the shaft?

A. It didn't rise immediately; those that were suffocated were on the lower levels; they were suffocated by the gases. Some of the men were gotten out, but the gases filled the lower portions of the mine very rapidly. But they were suffocated, not burned; they were burned afterwards; they met their death by suffocation: that might occur with a tunnel, but it would not be so likely.

Q. Do you think these laboring miners know something about mining?

A. Well, I think they do; yes.

Q. Well, what made you state before that the Miners' Union is in favor of this tunnel?

A. You invited gentlemen to meet us, and they so stated to us; we met them by your invitation, the head men of the Miners' Union.

Q. Did you come in contact much with those miners?

A. With the laboring men?

Q. Yes.

A. Yes, sir; I always seized every opportunity myself, when I was down in the mines, to converse with the miners, when the overseers or superintendents were not by.

Q. Do you think they would have been likely to tell you anything that would have been contrary to the wishes of the superintendents?

A. I don't know about that. We never asked them anything of a private character when their overseers were by.

Q. Didn't they seem to be afraid to answer questions when the overseers were present?

A. No, sir. I don't think the men did. We had men come to us at our rooms and give us information, and tell us that they didn't want to have their names known, for it would jeopardize their interests; but not in the mines.

Q. What did they mean by that?

A. I suppose they meant just what they said.

Q. They meant they would be discharged if they said anything in favor of the tunnel?

A. This man who spoke to us said he was afraid of that. Only one man of them made that request, that we would not give his name.

Q. Do you not think there is a sort of terrorism exercised over these men?

A. Well, there is no more terrorism exerted there than there is in every case of a large body of men hired by a large corporation. They all defer to the opinions of the employer necessarily.

Q. I want to ask you one or two questions here in regard to ventilation. Supposing this tunnel were in, and a

shaft connected with it, going up to the surface, and the thermometer would stand at the bottom of that shaft at 110° , while the air outside, above, would be say at 65° ; would that hot air rise up in that shaft and create a partial vacuum, and make the air from the mouth of the tunnel draw in?

A. It is impossible to answer that question. Any one would suppose that would be the case, but we went in a tunnel, and that tunnel was connected by a shaft with the open air above, and we found, instead of the draft being in the tunnel, up through this shaft to the open air, it was directly the other way; it came down the shaft.

Q. General, what is the name of that mine?

A. That is the Occidental.

Q. Now, will you permit me to ask whether you found any difference of temperature at the bottom of that shaft in the Occidental mine and at the surface?

A. Yes, sir; we found a difference of temperature.

Q. Where was it the highest—at the bottom of the shaft or the top?

A. I don't know that we tried it at the top of the shaft. I don't think we did. I didn't, and I don't know whether Professor Newcomb did or not; but on the whole exterior, on the outside of the mountain, at the mouth of the tunnel, the thermometer stood quite high.

Mr. SHOBER. What was the length of the tunnel, General?

A. About 1,200 feet.

Q. And what was the depth of the shaft?

A. I cannot answer that very definitely. I should think it was about 500 feet.

Mr. SUTRO. General, was there any material difference, as far as you recollect, between the temperature at the surface and the temperature at the bottom of that shaft?

A. Oh, certainly.

Q. A material difference?

A. Very material; yes.

Q. What was the difference?

A. I should think 15° or 20° .

Q. Where was it the highest?

A. It was the highest outside, at the mouth of the tunnel, and on top.

Q. Now, suppose that at the bottom of that shaft you would build a fire, where would that draught go to?

A. Well, that is impossible to tell—you can't tell.

Q. Suppose you build a fire in a chimney, where would it go?

A. Well, we all know it would go up.

Q. Isn't the shaft the same as a chimney?

A. It is very different, sir.

Q. What are the laws that govern the elastic fluids? Are they not always alike: those that govern gases or air? Do they not find their equilibrium always?

A. Yes, sir.

Q. Well, now, suppose at the bottom of a shaft the temperature stands much higher than at the top, wouldn't the natural result be, that the heat would rise up?

A. So any one would suppose; but, as I have said, it don't in all cases, and there is no use for you to talk about it. We know it is a positive fact that it goes the other way.

Q. Well, don't you think it is very remarkable?

A. It may be very remarkable, but it is nevertheless true.

Q. Suppose you were to build a fire at the bottom of a shaft 2,000 feet deep, at this point where the tunnel comes in and connects with the shaft, would you think that the smoke or the heat from that fire would go out of the tunnel, or the shaft?

A. I don't know why you want me to express my opinion again. I have already told you exactly what I know about the passage of the draught in respective tunnels and shafts; and I stated, moreover, that, when you have a tunnel and shaft connected, you cannot tell *a priori* which way the draft is going to be.

Q. No matter what the difference in temperature would

be at the bottom of this shaft, at the top of the shaft, or at the mouth of the tunnel?

A. No, sir; I don't say "no matter about it," because everything affects the question; but you may connect two shafts, and you cannot tell which way the draught will be till the draught is determined.

Mr. KENDALL. Let me ask General Foster as regards the advantages of ventilation: Would it, or would it not, make any material difference which way this draught should be, up the shaft or down the shaft?

A. I think it would make a material difference which way it should be. I think the best way would be to have the draught go down the shafts and out the tunnel; it would be much better for the miners. So that what Mr. Sutro is trying to have me say would be just the worst thing in the world for him.

Q. That is referred to somewhere, is it not?

A. Yes, sir; it is embodied in the report on page 9, I think.

Mr. SUNDERLAND. I think you say something with regard to the ventilation in the Yellow Jacket?

Mr. FOSTER. It is on page 6. On page 7 it is continued. (Commissioners' Report.) Those are the results of absolute observations.

Q. Which set aside all theories in the world?

A. Yes, sir.

Mr. KENDALL. You say here probably the mines would be most benefited by the air passing downward through them, and out at the mouth of the tunnel?

A. If it should pass the other way, in the way you would suppose it would naturally, it would be a great deal better for the miners.

Q. Yes, sir.

A. We thought of that a great deal, and came to that conclusion.

Mr. SUTRO. I want to ask you one more question, General, and then I will close. I want to ask whether any one

of those seven gentlemen, who made these published statements to you, is a graduate of any mining school?

A. You mean Colonel Requa?

Q. Several have made statements?

A. Yes; Colonel Requa, Mr. Batterman, Mr. Taylor, Captain Day, &c. Well, I couldn't state with regard to that. I don't know where they graduated.

Q. Do you know whether they have graduated at all?

A. I received a good many statements from Mr. Janin. I think he told me that he was a graduate of a mining school.

Q. Well, he was turned out, wasn't he?

A. He is not a superintendent now.

Mr. SUNDERLAND. There never has been a graduate of a mining school there yet that didn't turn out a failure.

Mr. FOSTER. I don't know whether they are graduates or not.

Mr. SUTRO. There isn't one on the Comstock lode that is a graduate of a mining school.

Mr. SUNDERLAND. No, sir, there is not; and we don't want them.

Mr. SUTRO. You may now take the witness.

The cross-examination.

Mr. SESSIONS. The air going down the shafts, you think, would be better for the miners than going up?

Mr. FOSTER. Yes, if it went in the way you would suppose it would naturally.

Q. Would that be more salubrious for the miners?

A. Yes. It would carry the vapors out and prevent their rising. If you work up from the tunnel, the up-work would receive all the heated air, all the vitiated air, you know, and make it doubly bad for them to work in; whereas if it went the other way, it might draw it out. Certainly it wouldn't receive this increase from below from the heads of the works. In the Dana tunnel, and in the Occidental tunnel, the draught goes out of the tunnel. In the Crown Point and Yellow Jacket mine, the draught at first was

down the Yellow Jacket, through the drift, connecting on the lower level, and up the Crown Point. When this fire occurred, it singularly enough changed that, and after the fire the draught was going the other way.

Mr. SHOBER. The fire was in the drift, and after that the current changed?

A. Yes, sir.

The CHAIRMAN. How did it occur?

A. I have forgotten how it occurred.

Mr. SUNDERLAND. Mr. King gives an account, I think.

Mr. FOSTER. King gives a full account. It was an accidental occurrence. They got the information, and started to get out; some of them did get out; they were hoisted out, and climbed up ladders. Some of them were found up a few levels above, where they clambered on ladders, and finally suffocated. The gas they were in was thick, and before they could get out of the shaft they died. The shaft was working, and they sent the cage down as far as they could, and men went down on the cage to get miners, but they could not get them out quick enough; they were suffocated.

Mr. SHOBER. Can that change in the current be accounted for in any way by reason of the fire?

A. No, sir. It is one of the anomalies of ventilation that you cannot account for. It seems to be an exceptional case, and all those cases referred to seem exceptional.

Mr. SUTRO. General, what makes that draft down one shaft and up another?

A. I can't say.

Q. Doesn't the heated air arising up one shaft create a vacuum, and it must come down the other shaft to replace it?

A. Well, I will answer it in this way: If you have two shafts on a hill-side, coming down on an angle of 45° , one lower down than the other, you will say that the larger one has a larger chimney. They are connected below. You build a fire in the middle of your connection. You say the larger chimney has the more heated air in it, and

the top is hotter than the lower one, and the draught should go the other way.

Q. No. I would first take a thermometer and see whether there be any difference at the tops of these shafts. If there was a material difference in the thermometer, the hot air would probably rise in the shaft where the air would be the warmest on top; but if there were no difference, the draught may go up either one or the other; but in the case of a shaft and the tunnel being connected, why the hot air, according to my ideas about the motion of air, is bound to rise up in a shaft, and be replaced by the cold air coming in through the tunnel.

Mr. SUNDERLAND. All other things being equal, the density of the air must be greater at the top of the lower shaft.

Mr. SUTRO. Well, if there is a material difference in elevation it must be so; but where there are only a few feet difference, (the difference between Yellow Jacket and Crown Point being but thirty feet,) it doesn't make any material difference.

Mr. FOSTER. Still there is a difference. The air is rarer, and ought to be hotter. No, you cannot reason upon that thing. It is one of those things that depends entirely upon the fact.

Mr. SUTRO. Well, I don't believe it is as much as 30 feet between the Crown Point and Yellow Jacket. Yes, it is. One is 433 feet, and the other 483; that makes a difference of 50 feet.

Mr. FOSTER. Where did the fire occur?

Mr. SUNDERLAND. It occurred in the 800-foot level of the Yellow Jacket.

Mr. SHOBER. What is the length of the drift where the fire occurred, between the two shafts?

Mr. FOSTER. I think it is 600 feet; it may be less than that; that is my recollection of it.

Mr. SESSIONS. What is the size of these drifts, generally?

Mr. FOSTER. Six feet by seven are the general dimensions.

Mr. SUNDERLAND. That is, outside of the timbers; the timbers go inside of that?

Mr. FOSTER. Sometimes they get down to five feet in width, to, say, six or seven in height.

Mr. SUNDERLAND. As we are on this fire here, I will ask you, General Foster, some questions about it, before I pass it over. You stated at the last meeting that these shafts, in all the principal mines, would be below the tunnel level before the tunnel could get in, did you not?

A. Yes, sir.

Q. Suppose, below the tunnel level, a fire should occur, as occurred here in the Yellow Jacket and Crown Point, could the tunnel then be of any benefit?

A. I don't see that it could be of any benefit; it might, of course. Some men might go out that way better than they could go up the shafts. In Crown Point mine many men were suffocated going up the pump shaft and climbing the ladders. If they could reach the tunnel, they could more easily go out of the tunnel than they could climb ladders.

Q. The loss of life in this fire was amongst men who were below the level of the fire?

A. Principally; yes, sir.

Q. Suppose the fire should occur in a level above the men at work below the tunnel level?

A. They must inevitably be suffocated, unless drifts were made to adjacent shafts, sunk down from the tunnel level, by which they could ascend and get out.

Q. The tunnel itself would be no safety to the men who were below the level of the fire?

A. No, sir.

Q. Did you examine the Sierra Nevada mine, when you were there?

A. No, sir; we went over the ground, but we did not go into the mine.

Q. Did you see them bringing out the ore?

A. We saw them bringing the ore out on their trucks from the tunnel, and we were told that they were mining

in that tunnel, and running the ore out through this drift at the top.

Q. They were getting it, then, I suppose, near the surface?

A. Yes, sir; and running it out of the tunnel, and throwing it down the chutes directly into their mill.

Q. Mr. King says, in his report, page 167:

"SIERRA NEVADA.—The mine just named has been prospected to a depth of 500 or 600 feet, involving the expenditure of a large sum of money, without developing important deposits of silver ore. Its good fortune has been since found in working the surface rock, which has proved to be rich in gold. The gold-bearing ground is not very high in value per ton, but, as it is easily extracted and cheaply milled, the work has been very profitable. Up to January 1, 1869, the company had assessed nearly \$500,000 without very satisfactory results. About that time the importance of its gold-bearing surface deposits became known. A mill was erected on the property, close by the source of ore, and commenced operations, milling the rock for the gold only, without attempting to save silver. This simple process consists of amalgamation in the battery, and on copper-plated tables in front of the battery, avoiding all expense for pan treatment.

"During 1869 the company produced and milled 18,000 tons of rock, yielding \$155,971 36, or an average of \$8 66 per ton. The expenses per ton were as follows: For mining, \$1 92; milling, \$3 03; incidentals, \$0 72; making a total of \$5 72, and leaving a profit of \$2 94 per ton. During the year referred to there were no assessments, and the dividends amounted to \$45,000."

Now, in mining in the manner in which that mine is worked, would the tunnel be of any benefit?

A. No, sir.

Q. What is the dip of the vein in that neighborhood?

A. The Comstock?

Q. Yes, sir.

A. Forty-five degrees.

Q. Could you lower the ore from there down to the tunnel level as cheaply as it can be run out through the way it is now run out?

A. No, sir.

Q. What would be the means of lowering the ore there at that dip of the angle, calculating the distance it would be east from where they are now at work?

A. The ore might be precipitated down successive chutes. There might be a difficulty about making one continuous chute. I believe they have found by experience that they must have chutes not much larger than a hundred feet, to avoid their being choked up, so as to produce a great deal

of trouble in clearing them out. They might arrange a succession of chutes, down which the ore could be sent. Those chutes would have to be attended, and each landing would have to have men to shove the ore on. It might be lowered also by cars, running down an incline.

Q. How high would it be necessary to rise? Do you know the difference between the altitude of the Sierra Nevada and the point that I mark on these maps here? [Exhibiting on atlas.]

A. I do not.

Q. It is not given on the maps. It is a little lower than that point.

Mr. SUTRO. It is 200 feet lower.

Mr. SUNDERLAND. What would be the probable expense of raising, supposing the tunnel to be in, and raising from the tunnel level up to the point where they are at work now, and constructing an incline to lower ore into the tunnel?

Mr. FOSTER. It would cost as much as it would to raise a shaft that distance, being so steep. It would cost just as much as it would to raise a shaft vertically.

Q. How far, General, is it safe to let ore drop perpendicularly, to avoid the breaking of timbers?

A. I believe 100 feet is the limit.

Q. Do you know any perpendicular chute where they let ore fall 100 feet?

A. No, sir, I do not. The chutes that I know of 100 feet are inclined chutes.

Q. Not perpendicular?

A. No, sir.

Q. Did you notice that there was any wear and tear of the timbers?

A. Yes, sir; very great.

Q. The Chollar Potosi, I believe, has been a very successful mine for the last two or three years, has it not?

A. I believe it has; yes, sir.

Q. Do you know how deep they work?

A. They have worked very deep; I believe to 1,100 or 1,200 feet: At present they are not working so deep.

Q. I am speaking now of the present depth to which they are working?

A. They are working near the surface.

Q. Near the surface?

A. Yes, sir.

Q. You stated that you did not go into the Sierra Nevada. You didn't see any difference of water there, did you?

A. No, sir.

Q. Is there any water in the Chollar Potosi where you have been? You have been in the Chollar Potosi?

A. Yes, sir.

Q. Was there any water there?

A. I didn't see any. The lower shaft was filled with water.

Q. The lower shaft is not being worked at all.

A. No, sir. They had suffered it to become filled up with water.

Q. In the shaft that is now working, to the depth at which they are working, is there any water at all, any appearance of water, any running water, or any pumps?

A. No, sir; I didn't see any.

Q. The last report of the Chollar Potosi shows that there were some 84,000 tons worked. I am referring to Mr. Requa's report, or rather the report of the president, including Mr. Requa's?

A. Mr. Requa reported to us that he had done no pumping for the last two years.

Q. In the report made at the last annual meeting of the company, in June, 1871, the president says:

"The dividends paid during the year aggregate some \$2,000,000."

The superintendent gives as the gross proceeds \$3,459,423 08. Could the tunnel have been of any benefit to that company in working that mine?

Q. You mean working, as they have been working recently, in the upper levels?

Q. Yes, sir; for the last year.

A. No, sir; I don't think it could.

Q. You saw them at work in the lowest levels. Do you remember how deep they were working?

A. I think they were working 600 feet deep, but I am not positive with regard to that.

Q. I guess you are mistaken about that.

A. We went into different levels.

Q. How is the most of the ore taken out there, General?

A. It is—

Q. I mean through a tunnel?

A. It is run out through a tunnel. It is one of the upper tunnels, 200 or 300 feet down. They have a tunnel running out to their dump. They have two or three adits at different levels.

Q. They were taking the ore right out from the surface, were they, when you were there?

A. Yes, sir.

The CHAIRMAN. Why did they construct those tunnels?

Mr. FOSTER. Well, the opinion was favorable to tunnels at that time. A great many tunnels were started there. There was the Latrobe tunnel, that was run in for several thousand feet, and ruined two or three men. They went entirely through the Comstock lode to the west-country rock, and singularly enough they didn't find any ore. That is abandoned now. It is a very long tunnel. These other tunnels are nearer the surface, right up, and they are used to get the ore out of. They use this one now, and they use all the tunnels, I believe. They are used for different purposes.

Mr. SUTRO. We have a map here which shows all the tunnels on the lode. There are probably 30 or 40 of them.

Mr. SUNDERLAND. I will read you the report which shows how deep it is. In the last annual report, after referring to the Belvidere lode as containing a large number of tons of good ore, the superintendent of the Chollar Potosi says:

"Results establish the fact that no overestimate was made. On this lode the rule is, that these ore deposits are not regular in their form; this ore has

proved no exception to the rule. Consequently, to give a description of it, resort is made to an average. The stope, as viewed, would nearly resemble a regular body of ore of one hundred and forty feet in length, forty-five feet in width, and running from the Potosi tract floor up toward the surface two hundred and twenty feet."

He says where he ran in here it was 220 feet from the Potosi tract floor up to the surface: 220 feet.

"The quality of ore was very regular; much the larger portion extracted required no assorting. The whole was standing on an angle to the eastward of twenty-eight degrees.

"Down from Potosi tunnel level (that is 220 feet from the surface) fifty feet the clays came together, in a manner that gave an appearance of the ore having been entirely cut out."

That makes 55 feet and 220 feet?

A. Yes, sir; 275 feet.

Q. Well, now, would it be possible to mine or mill any cheaper from that mine in case a tunnel were in to-day?

A. No; it wouldn't be any cheaper where they are mining now, in that bonanza.

Q. Well, that is what I speak of. That is all the ore you saw in the Chollar?

A. That is all I saw in the bonanza there.

Q. Isn't that all that has ever been discovered?

A. I believe it is; yes, sir.

Q. Did Mr. Requa report to you what it costs to mine that?

A. Yes, sir.

Q. Do you remember the figures?

A. About \$8 a ton.

Q. To mine?

A. Oh, no; I am not thinking of Mr. Requa. Mr. Requa did report to us, and I had my note-book. I am not positive that that is the figure he gave me. About \$5—it is stated there \$4 69.

Q. Milling \$12 per ton?

A. Yes, sir.

Q. Now, I will get you to look at these tables, and see if the \$4 69 don't include every expense connected with the mine, except that of milling?

A. Yes, sir.

Q. That includes all the expense?

A. Yes, sir; all the cost of extracting the ore.

Q. I will now ask you to state from that table what taxes were paid that year. You will find it in the table there.

A. Taxes, \$21,971 29.

Q. Will you see what the legal expense was?

A. Legal expenses, \$4,885 20.

Q. That is all I want in connection with that. I simply show these as specimens of the expenses of the mining company outside of the sinking of the shaft and the pumping of water. [To the committee.] I wish to say, Mr. Chairman and gentlemen of the committee, that, as long as the truthfulness of the reports made by the mining superintendents has been called in question, I may be compelled, in the discharge of my duty, to ask the committee to adjourn until I can get witnesses from Virginia City, who can be sworn and testify to the facts, or else ask the committee to make a report to the House of Representatives recommending the appointment of a joint committee of the two branches to go out there, with power to send for persons and papers, and find out the facts. I am ready, if I have an opportunity, to prove my case. At present it is impossible to get witnesses here from there. The commission which went out there was not authorized to swear witnesses, to examine books, to send for papers, and to make that investigation which it now seems is necessary to have. If these reports are still called in question, I shall ask the committee to make that recommendation to the House. I would like to ask General Foster one question more. If he ever applied to any superintendent or clerk of any company there to see the books of the company?

Mr. FOSTER. No, sir.

Q. Was facility, that you ever hinted you desired, refused you, to gain all the information that could be gained by you while you were there?

A. No, sir. We didn't understand our duty as requiring us to verify the accuracy of the statements made offi-

cially to us. We had certain specific points to ascertain and report on, which points were given definitely in the law, and we confined ourselves strictly to the investigation of the facts under those different heads. We did look over some books, but not to extract from them any lengthy or consolidated statement. We were not refused anything that we asked for. On the contrary, we were told by everybody that they were desirous of having a fair exhibit made of the facts in the case. They didn't wish to conceal anything, and they would do anything they could to further the investigation. They considered the interests of Virginia City as dependent upon this great interest of mining, and they wished to have a perfectly fair investigation. We were obliged to have our report in by orders on the 1st of December. We had no time to spare to make a lengthy examination of books. We were not authorized to hire experts and accountants. We had to do all these things ourselves, and we got home in September. We immediately went to work consolidating our information and preparing our report, and we got it in on the 1st of December. We were fully occupied from the moment of the time we started. We had no idea that these representations, made officially to us, would be doubted, and they covered the grounds of our investigation, as we understood them under the law.

Mr. SUTRO. Mr. Chairman, it seems to me that we have all the material here necessary to get at the facts in this case. We have, in the first place, the statements of seven superintendents attached to this report, and upon which the report is based to some extent; we have the reports of Mr. Raymond, the United States commissioner on mining; we have Mr. King's report; and we also have the reports of these mining companies from year to year; and by instituting a comparison of these materials, I think we can arrive at a very clear conclusion as to what may be taken as correct and what incorrect.

The CHAIRMAN. The sub-committee has only limited powers. No authority has been delegated them to send

for persons and papers, or to make any arrangements for the investigation beyond the limits that have already been assumed or designated. If the sub-committee report that they are unable to arrive at a satisfactory conclusion, why, then, it is for the whole committee to determine whether they will ask for extended power from the House. That is a question that would only be determined in the committee.

Mr. SUNDERLAND. I did not suppose that the sub-committee could determine it. The first time the whole committee met, and I was asked if I had any witnesses here. I said I had not, because I relied on the reports.

Mr. SUTRO. If I understand correctly, Mr. Sunderland wants to go outside of the records. We were to take the reports of the commissioners, together with the statements attached thereto, and the official reports made by the Government, and also the reports of these mining companies.

Mr. SUNDERLAND. We have gone outside of the record all the time.

The CHAIRMAN. As one of the committee, I have been inclined to get all the information possible. We have been giving you all the latitude you require. It only imposes additional labor on the committee, in sifting out from this voluminous testimony what is the desired evidence in making up their report to the general committee. We are certainly traveling over a great deal of ground, and I don't know whether this committee will ever be able to arrive at the gist of the thing.

Mr. SUNDERLAND. Gentlemen of the committee will bear witness that I have not gone over much ground.

The CHAIRMAN. I did not intend that as a reflection. It cannot be so construed. But I suppose it is the desire of the parties in controversy that the committee arrive at a conclusion as speedily as possible, and elicit all the facts that are necessary to be considered in making up the report. I know it will be very satisfactory to the committee, if inquiries were made more direct, and confined more to the subject-matter.

HEARING ON WEDNESDAY EVENING, FEB. 21.

Mr. SUNDERLAND. (Resuming cross-examination of General Foster.) Did you visit the Overman mine while you were at Virginia City?

A. No, sir; I did not, myself. The other members of the commission visited it. I was not with them at the time.

Q. You took some pains to ascertain the cost of mining and milling there, did you not?

A. We consulted their report in regard to it.

Q. Mr. King says, on page 187 of his report, that the average value of ore is generally stated at \$20 to \$25 per ton. (This is from the Overman.)

"The only positive information on this point in the possession of the writer is based upon the prices from July 7, 1869, to Jan. 10, 1870, when, according to the official accounts, there were 11,392 tons of ore crushed, producing \$166,696 04, or an average per ton of \$14.63."

Could that ore pay a profit, after paying the royalty of \$2 a ton under the act of Congress to the Sutro tunnel?

A. It is generally conceded that the extraction of the ore and the milling, where the mine is at great depth, say 1,200 feet, would cost about \$20 a ton. This was not obtained from a great depth, but from a depth of 700 feet. I should think it would cost them nearly that amount to mill and mine, and that they could hardly afford to pay a royalty out of the production at that rate.

Q. When you speak of milling, do you mean to say that it costs the mill so much per ton to reduce the ore, or do you mean to say that the mine pays to the mill so much per ton?

A. I mean to say that the mine pays to the mill and to the persons who convey the ore to the mills, in gross, about \$12 a ton. That covers the transportation and the amount that is paid to the mill owners for obtaining the ore from the rock.

Mr. SUTRO. May I ask the General a question right here?

Mr. SESSIONS. If Mr. Sunderland is willing.

Mr. SUNDERLAND. I have no objection now, but generally I don't want to be interrupted.

Mr. SUTRO. General, you say you have never been at the Overman mine?

A. I haven't examined it. I don't recollect.

Q. What had you found out about the cost of mining and the mining difficulties there? How can you tell whether they can afford to pay any royalty or not?

Mr. SUNDERLAND. Well, I object to the question.

Mr. SUTRO. On what grounds?

Mr. SUNDERLAND. Well, I don't want to be interrupted.

Mr. SUTRO. I have asked permission to ask this question, and it has been granted, hasn't it, Mr. Chairman?

Mr. SUNDERLAND. Well, then, go on.

Mr. SUTRO. Then I put the question.

Mr. FOSTER. I know as much about it as any person who goes to a locality and ascertains from testimony and documents what it costs generally to mill and mine: who compares the depth of this mine, as stated, with the depths of other mines, and considers the cost of mining, and exercises his judgment to institute a comparison.

Mr. SUTRO. General Foster, you say you have not been at that mine. You do not know anything about the quantity of water in that mine. You do not know anything about the circumstances of that mine. There is no royalty to pay, unless the tunnel is in and drains the mine. Now, how can you judge whether they can afford to pay that royalty or not, not knowing anything about these things.

A. Well, I must be my own judge as to whether I can form a judgment, and not you.

Q. You have just stated that you haven't been to that mine.

A. No; I beg your pardon. I said that I hadn't examined it.

Q. Well, what do you know about it, then?

A. I have just stated what I know about it.

Q. Do you know anything about the condition of the water in that mine?

A. No.

Q. That is all.

Mr. SUNDERLAND. I believe, General, that you base the advantages of this tunnel, so far as the Comstock lode is concerned, upon two propositions: one of which is the feasibility of reducing all the ore at the mouth of the tunnel by power from the water of the Carson river; and the other, to concentrate or work by other means, not now known in this country, the ores at a less expense than they are now worked?

Q. Yes, sir; those two points we considered as forming an essential part of the whole project.

Q. Those two things alone, as I understand, were principally to benefit the Comstock. Now I am talking about the Comstock lode, I will ask you if all the water power on Carson river, from the first fall that it has after turning into the valley, to the last fall it has in its course, is not now utilized by means of mills upon the river?

A. Well, I think not all. I think there is a fall below the Merrimack mill, at which point it is contemplated to erect a new mill, which will, however, utilize, when constructed, all the water power.

Q. All the power in the mill?

A. Yes, sir. It is proposed to erect a mill, to be called the Excelsior mill, which will take all the remaining water power in that locality.

Q. And that power connected with the Vivian, which is a little mill just below?

A. I believe that is the name; yes, sir.

Q. I will ask you whether it is not cheaper to utilize the water power in that river by a succession of dams and mills than it is to build one immense dam, and take all the water out in one race or flume?

A. Yes, sir; I should think it would be, as far as the mere point of gaining power is concerned.

Q. Do you know whether the land adjacent to and on each side of the river, and the water rights upon it, have been acquired by the parties in possession?

A. I have been told that such was the fact.

Q. Patents issued to the property?

A. I have been told so; yes, sir. The commission were informed so by some of the parties that owned the privileges.

Q. Do you know anything about this idea of concentrating ore, as has been suggested by Mr. Sutro?

A. Since the idea was started, or since it was entertained by the commission in connection with the project as an essential part of it, we directed our attention to acquiring all the information possible in time for our report upon that subject. We visited the mines at Franklin, Pennsylvania, where they had reduction works in operation that are said to be like those that are used in Germany and in the Cornwall, in England. We also visited the Lehigh Zinc Works, near Bethlehem, Pennsylvania, where it was said that machines were used in Germany that were similar to those; and I believe they were imported from Germany—the plans and descriptions at least. We saw that a considerable reduction was made, but we were not satisfied that the machines that were used would be of service upon the Comstock lode. We also sought information from mining engineers in New York, and obtained a good deal of information that way. That, however, we had to receive verbally, as merely personal testimony. We saw articles in the scientific journals describing those machines, stating the saving that could be made by their use in the extraction of the ore. We had no further evidence than that.

Q. General, I guess you have used a term there you didn't intend to—extracting of the ore. That means extracting from the mines?

A. I mean concentrating of the ore. We visited the American Institute, and saw one or two machines there—new inventions—said to be improvements upon the German machine; and I believe them to be improvements. We

thought perhaps they might be used, but we were not positive; we couldn't tell.

Q. In what way would the concentration of ores cheapen their reduction?

A. In this way: After the rock has been pounded up, pulverized, reduced to a state of pulp, the ore can be concentrated in a certain part, so that only a portion need be treated for the extraction of the metal, allowing the rest to be thrown away, as being far below the standard. It is merely a saving of labor and machinery in the operation. The increased richness of the concentrations requires greater care and expense per ton in saving the metal than are required in the reduction of the ores as practiced at the mills in Nevada.

Q. You will lose some of the metal in concentrating, I suppose? You don't save it all?

A. You lose metal. Yes, sir. I can hardly answer that question. It would probably take more quicksilver to the ton. The loss would be something considerable in that respect. In discarding the crushed portion of the ore—the pulp that is not to be treated at all—we lose so much: that is loss.

Q. Now, I will ask you, General, if there is any advantage in concentrating ores before amalgamation or other treatment beyond concentration? I want to know if there is any advantage in concentrating the ores of the Comstock lode, whether it cannot be done just as cheaply at the mills, as they now exist upon the Carson river, as it could at the mouth of the tunnel?

A. With proper machinery, I think the reduction and extraction of the metal could be done as cheaply in one place as the other.

Q. Well, I didn't, as a matter of course, mean to say that there was any machinery there now for concentrating. I mean to say that with the power there, and all the appliances of machinery for concentration, couldn't the work be done just as cheaply there as at the mouth of the tunnel?

A. Yes, sir; I think it could, just as cheaply.

Q. Will it cost any more to prepare the work for concentration at the different mills than it will at the mouth of the tunnel—the different mills on the Carson river?

A. I should think there would be very little difference in the cost in either case; very little difference. But if there is an advantage, it would be on the side of having the concentration works all together, I should think, because you build a large establishment much cheaper in proportion than you can several small ones of the same combined capacity.

Q. Did you visit the Eureka mill, in process of construction on the Carson river, while you were there?

A. Yes, sir.

Q. Do you know what the capacity of the mill will be when completed?

A. I cannot tell now. I made notes of the capacity of every mill and of its condition, and the note-books are in the possession of General Wright, the senior officer of the commission.

Q. Do you remember the fall at the Eureka mill?

A. I do not.

Q. Do you remember the estimated cost of the mill?

A. No, sir; we visited so many mills, and they were all so very nearly alike. There was very little difference between them. I made particular notes of the capacity, cost, and value of each mill, but I have not those notes with me.

Q. Well, it had the foundation of a large mill, had it not—the largest one in that country?

A. Yes, sir.

Q. At that particular mill, would it be any more expense to attach to the power there the machinery for concentration than it would anywhere else?

A. I should think not.

Q. Did you visit the Brunswick mill, in process of reconstruction?

A. Yes, sir.

Q. Would there be any more expense there?

A. No, sir.

Q. Any more expense at the Mexican mill?

A. The Mexican mill is being—

Q. The Mexican mill is the mill at Empire City; 44 stamps?

A. No, sir; there would be no trouble in attaching the additional machinery at any one of those mills.

Q. Any good-sized mill, I suppose you mean?

A. Any mill of sufficient capacity.

Mr. SUTRO. Will you please state, Mr. Sunderland, what you refer to—what concentration—the concentration of what?

Mr. SUNDERLAND. Ore.

Mr. SUTRO. The concentration of ore, is it?

Mr. SUNDERLAND. Yes, sir; what we have been talking about. Now, there is another question connected with this, the practicability of getting the water from the Carson river to the mouth of the tunnel. Have you made any estimate yourself upon the cost of that work, General?

Mr. FOSTER. We made some very rough estimates; nothing in detail. We entered into no details with regard to it. We left that to General Day, whom Mr. Sutro engaged to have make the estimates; and he has rendered mere skeleton estimates of the sum in gross. I have made a few figures, to estimate the cost of building a large embankment, in order to strengthen the center of the dam, which would have to be made impervious to water, and considered it necessary that it should be embanked on both sides: strongly embanked with rock, blasted from the mountains on either side. The center of the dam can be strongly padded, and it may also be made of plank. The cost of such a dam, laid as cheaply as I could make it, would be somewhat more than General Day has estimated, but not a very large sum.

Q. What is the highest dam which you have seen or know anything about in the United States?

A. I can hardly answer that question. I have seen the Lowell dam and the Philadelphia dam. I should say, not over 60 feet.

Q. This is to be 155 feet, I believe; isn't it?

A. That is the idea; yes, sir.

Q. Where is it proposed to build that dam, General?

A. The site was not definitely fixed. It might be built near the Franklin mill, about 700 yards above it, or still farther up the river, where there is a narrow gorge. It could be built best where the river is narrowest, and where the mountains on either side would furnish the requisite amount of rock.

Q. I believe I understood you to say that you were informed while there that all the land and the water power along that river were private property?

A. I don't recollect being informed that the land was private property. The water privileges, I was told, were owned by private parties. I don't know whether the water privileges and the land go together or not. Sometimes they do not.

Q. What property would that dam flood?

A. It would flood everything back to the Mexican dam.

Q. What property is on the river above the Franklin dam and the Mexican?

A. The Eureka mill, the Franklin mill, the Brunswick mill, the Excelsior mill. I don't recollect any other mills.

Q. Mexican?

A. Yes, and the Mexican.

Q. The Morgan mill, or Yellow Jacket?

A. Oh, yes; the Yellow Jacket.

Q. Vivian?

A. Yes; I had forgotten that.

Q. Did you name Merrimack?

A. Yes, the Merimack. It would flood the ground occupied by all of those mills.

Q. Would it not flood the town of Empire City?

A. It might do so, sir.

Q. Isn't there a fall there, General, of over 20 feet, at the Mexican mill?

A. Yes, sir.

Q. Is that mill built upon a level with the town? Is the foundation pretty near on a level with the town?

A. Yes, sir.

Q. Then, if it floods the country back to the Mexican dam, it must necessarily flood Empire City?

A. The flood would be up to the base of the dam. You couldn't flood to the top of the dam, because that would destroy the power of the Empire mill.

Q. Well, I should suppose it would destroy all these mills?

A. No, sir; it would destroy all up to the Mexican. You have the flood going to the base of the dam.

Q. Is that the proposition?

A. Yes, sir.

Q. Just look at that, General. [Exhibiting draught.] I think you are mistaken about that. I think that is the top of the Mexican dam.

A. No; it don't state so here. It shows the height of dam at level of Mexican dam; but the intention was to flood back to the base of the dam, so as to allow the Mexican mill to run with its present power, and to avoid flooding Empire City, if possible. That was the idea. I don't know whether General Day took his levels at the top of the dam or not; but the idea was to take the levels at the bottom of the dam.

Q. What is the population of Empire City?

A. I do not know.

Q. Several hundred?

A. I should judge it to be two or three hundred; yes, sir. It is a very small settlement.

Q. Do you remember the depths of these main shafts while you were out there, General?

A. No, sir; I cannot give them exactly. They were all given upon the map that we sent in with our report. I can give the depths of some of them.

Q. The last report of the Gould and Curry company, made 25th of December, 1871, says, that during the year two compartments of the shaft have been sunk 294 feet, mak-

ing the entire depth 1,485 feet, or, measuring from section A, at croppings, 1,685 feet?

A. Yes, sir.

Q. How much is that above the tunnel level?

Mr. SUTRO. What shaft is that, General?

Mr. FOSTER. The Gould and Curry.

Mr. SUTRO. From what point are those 1,685 feet?

Mr. FOSTER. Point A.

Mr. SUNDERLAND. There is the depth you give in your report on page 5.

Mr. FOSTER. 1,898, close to 1,900.

Mr. SUNDERLAND. Call it 1,900.

Mr. SUTRO. Where is that 1,685 derived from?

Mr. SUNDERLAND. From the report of the superintendent of the Gould and Curry.

Mr. SUTRO. Is that the statement of the superintendent of the Gould and Curry mine?

Mr. SUNDERLAND. Yes, sir. [To Mr. Foster.] Now, if this same progress of 294 feet in a year continues to be made in the sinking of that shaft, how long will it take to reach the level of the tunnel?

Mr. FOSTER. About nine months.

Q. Do you remember the depth of the Savage shaft?

A. No, sir; I do not. It is given here as 1,262 feet. They haven't got down much beyond that.

Q. Do you know on what level this ore was struck here within the last few weeks?

A. No, sir. If I recollect aright, it was on the 1,300-foot level.

Mr. SUTRO. It is on the 1,400-foot level. That's where it is. The 11th station.

Mr. SUNDERLAND. Do you know the depth of the Hale and Norcross shaft?

A. No, sir. It is given as 1,397 feet. I don't know what it is now. All these depths are given upon the maps that we sent with our report.

Q. Do you remember the depth of the Crown Point shaft?

A. Yes, sir; 1,500 feet.

Q. From where?

A. From Point A; 1,500 feet. The Crown Point is now down about 1,700 feet from the Point A.

Q. That's about it. It is over that, however; but it is near enough. Do you know what progress they make in the sinking of these shafts? But I will ask you about the Imperial. Did you go into that?

A. No, sir; I did not.

Q. Were you told anything about the depth of that shaft?

A. No, sir.

Q. What was the general progress made in the sinking of those shafts per year? How long did it take to sink a hundred feet—one level?

A. They progress from three to six feet a day, about a mean of three feet a day.

Q. Then supposing it were to take three years to get the tunnel in, at what level would these shafts be when the tunnel gets in—the principal shafts?

A. They would be below the tunnel.

Q. How far?

A. They would be at this rate from 250 to 500 feet.

Q. Then of what advantage could that tunnel be to the mines whose shafts were below the tunnel level?

A. It would have this advantage: What water is found below that in the bottom of the shafts could be pumped up and run out of the tunnel, instead of being pumped from the tunnel level to the surface.

Q. Or to the adit, where the water is now discharged?

A. Yes, sir. And the same thing with regard to the ore. The ore could be carried out through the tunnel, instead of being raised from the tunnel level to the surface, as at present.

Q. Do you know what charge is made under this act of Congress for mining the ore out?

A. It is 25 cents a mile per ton.

Q. Does it cost anything like that to raise ore from a depth of 1,900 feet to the top of these shafts?

A. The mean cost of raising ore from 1,000 to 1,300 feet depth is 51 cents a ton.

Q. Well, continue it down to the tunnel level?

A. At tunnel level the expense was estimated at 75 cents per ton.

Q. What would it cost to run it through the tunnel under the act of Congress?

A. \$1 25.

Q. There could be no advantages for ventilation below the tunnel level, in consequence of the tunnel, could there?

A. I don't see any over-shafts connected. I don't see that there would be any advantage by the tunnel over the present system of working below the tunnel level.

Q. I want to read now a part of this contract between the Sutro Tunnel Company and these different mines, in order to lay the foundation for one question.

"During the time when said party of the second part shall use said tunnel or drifts as means of transportation, as hereinbefore contracted for, the party of the second part will pay to the parties of the first part, for each ton of ore, rock, earth, or debris removed from the point hereinbefore designated to or beyond the mouth of the tunnel, as the case may be, the sum of twenty-five cents per mile, from the place of removing it to the place of discharging it, and, at the same time, for all material conveyed from the mouth of the tunnel to said point of connection heretofore described, forty cubic feet of timber, or 2,240 pounds of rock, ore, or other material, being considered a ton, and will also pay the said parties of the first part the sum of seventy-five cents each way for each man conveyed to and from said point at the request of or on account of the said second party; all laborers, employes, agents, and other persons connected with said corporations of the second part to be included and paid for as above stated."

Mr. SUTRO. May I ask, Mr. Sunderland, what you are reading from?

Mr. SUNDERLAND. The contract between Congress and the Sutro Tunnel Company. Then there are several provisos, among which is this:

"*Provided further*, That no such payment shall be due or made until the works of the parties of the first part shall have either actually drained said mine, so as to obviate the necessity for all other modes of drainage, or shall be prosecuted to the extent in the next article mentioned, which shall be deemed and considered sufficient drainage within the meaning of this agreement.

"ART. XIII. It is mutually agreed that the true intent and meaning of these articles, as to the draining of the mine of the party of the second part, are, that whenever the said mine is actually drained by the works of said first parties, so as to render all other drainage useless to the lowest level attained by the works of the said party of the second part, but not lower than to the level of the tunnel, the same shall be deemed a full compliance with the

covenant of the parties of the first part for the drainage thereof, and whether said mine be so drained or not, it shall be deemed and considered drained within the meaning of this agreement, in either of the following events:

"If the main tunnel shall intersect the Comstock lode, and cut the eastern wall thereof between the north and south boundaries of the mine of the said second party, the mine shall be considered drained.

"Or it shall be considered drained if the main tunnel shall cut said eastern wall outside of those lines, and the parties of the first part shall extend the lateral drift hereinbefore covenanted to be extended within said Comstock vein, to a point equidistant from such north and south boundaries.

"Or it shall be considered drained upon the expiration of three months after the parties of the first part shall have extended said drift outside of said lode, but within five hundred feet east of the west wall thereof, to a point not more than five hundred feet east of said west wall, whence a drift at right angles would enter said lode at a point equidistant from the northern and southern boundaries of the claim of the second party."

That would make it necessary, General, would it not, for each mining company to run a drift 500 feet east, to meet this tunnel?

A. From the west wall?

Q. From the west wall.

A. Yes, sir.

Q. Now, then, how much less expense would it be to connect all these principal shafts of the Comstock with each other than to run that drift east to this tunnel?

A. It would be, taking the principal mines—the Overman, the Belcher, the Crown Point, and the Yellow Jacket—somewhat more difficult; it would involve more work to connect the shafts than it would to run out to the tunnel.

Q. Not much more?

A. About 400 feet.

Q. Four hundred feet more?

A. Yes, sir.

Q. Do you know, General, whether, to get ventilation, it is necessary to connect on each level of say 100 feet?

A. To get ventilation in the shafts?

Q. To get ventilation in the works, in the stopes, in the drifts—everywhere in the mines.

A. Yes, sir.

Mr. SHOBER. May I ask what you mean by connecting it?

Mr. SUNDERLAND. Running a drift from one to the other. I would like to have the committee—any member of it—ask a question at any time when suggested, because the

matter can be easily explained, if there is any misunderstanding. What else is done there, in order to get ventilation in the mines, besides running these drifts from one shaft to another? Are there any winzes made from one level to another?

A. Yes, sir; winzes are made to connect one drift that is above another—a vertical connection.

Q. Would a single horizontal connection, by means of a drift between one shaft and another, be of any considerable benefit to a mine by way of ventilation?

A. It would ventilate thoroughly the shafts and this connecting drift, but it would not necessarily ventilate any other portions of the mines.

Q. Were you in any drifts there connecting different shafts, where the current of air was so strong that it was necessary to put up doors to break the force of it?

A. Yes, sir; that is between the Crown Point and the Yellow Jacket.

Q. On what level?

A. I think it was the 940-foot level.

Q. How far outside of that drift did you feel the effect of the current of air that was passing through the drift?

A. Well, only a few feet. As we stepped into the branching drifts we only felt it a few feet.

Q. Then, as I understand you, after getting this current of air from one shaft to another, it is necessary to direct it down through winzes, from one level to another?

A. Yes, sir.

Q. In order to get it in the part of the mine where the men are at work?

A. Yes, sir.

Q. Now, can you, by any possibility, with or without a tunnel, get air into the stopes after you get a few floors above the track floor, or in the fall of a drift, where you are prospecting a new drift, except by artificial means, by pumping or blowing?

A. Not that I know of. It is thought to be the only method known on the Comstock lode, by blowers, and I

can see no other way of working those places, those stopes and headings of drifts.

Q. Now, General, I will get you to look at those maps here, [exhibiting maps,] and tell the committee whether it is possible, by any means in the world, to ventilate all that space that is represented here as worked out?

A. Yes, sir, it would be possible.

Q. How would you do it?

A. In the first place, the bottoms of all the shafts must be connected, as shown upon the map here. They must also be connected at these different levels right through. Then, in addition, the connections must be made between the drifts of different levels, one hundred or two hundred feet apart, vertically connecting them down at their extremities. That would induce a circulation through all the drifts—by means of these winzes—and through all the shafts.

Q. Suppose that this means of ventilating the whole Comstock were used, and that enough air came through the tunnel to fill the whole of the lode, as it is worked out and shown on these maps, could any man stand up in that tunnel?

A. The current of air would be very strong. I don't know whether the capacity of the tunnel might not be sufficient to allow a pretty good draught there, without throwing a man down. It would be very strong. The size of the tunnel is about 14 feet by 13.

Q. That is larger than the contract provides for. I don't know what it is now.

A. It would produce a very strong draught in the tunnel.

Q. It would be difficult to work in it, would it not?

A. Well, I don't see why it wouldn't be difficult. The draught would be very strong.

Q. General, how wide did you see bodies of ore worked?

A. I saw the Crown Point bonanza; that was 80 feet wide.

Q. Is there any disposition of the ground on either side,

or both sides, to cave or fall in? Is it necessary to protect the sides of the veins?

A. No, sir; on one side not. The west-country rock was the side of Mount Davidson. The east-country rock was difficult to retain in place. It overhung the vein. That had to be retained in its place by supports.

Q. Is it possible to work that mine anywhere, where ore is taken out, without timbering?

A. No, sir; I should say not. As soon as ore is taken out, the space left must be filled with timbering.

Q. Is it possible for any amount of timber, any reasonable amount of solid timber, to stand, without the spaces between the timber being filled up?

A. No, sir; considering the swelling of the rock, it would be apt to throw it over.

Q. Is it usual, and do you consider it prudent, to fill up each floor as you ascend from the track floor up—to fill up with debris, waste rock, dirt, earth, in between the timbers?

A. Well, it would have to be done. I don't know whether it would be safe or not without.

Q. It is done, isn't it?

A. It has to be done?

Q. All got to be filled in?

A. Yes, sir.

Q. Now, you were asked the other evening by Mr. Sutro whether the timbers wouldn't last much longer under other circumstances, and I believe the conclusion arrived at was that they would last thirty years.

A. In such a locality, if there were proper ventilation?

Q. Yes, sir?

A. Yes, sir.

Q. Now, then, is it possible to ventilate these mines, after they have been worked out in this way and filled in, so as to preserve the timbers?

A. No, sir.

Q. You became fully well acquainted with the superintendents while you were out there, did you not?

A. Yes, sir; we were constantly thrown together. We sought information constantly from them, and became quite well acquainted with them.

Q. Taking them generally, were they men of character and intelligence?

A. Yes, sir; decidedly so. They were men of character and standing, and men that were entitled to the confidence certainly of their employers and of the public, I think.

Q. Did you hear anything said against them while you were there; any of them at all?

A. Not generally; no, sir.

Q. You have been asked if these men were not coerced. At least, that is the substance of the question—whether they were not coerced into making these reports?

Mr. SUTRO. That question was never asked.

Mr. SUNDERLAND. Did you see anything while you were there to indicate or lead you to suspect anything of the kind?

A. I saw nothing that would lead me to suppose that any coercion had been exercised at all. One party came to us to give us information, who stated he was a miner, and that he came to give us information privately, and that he did not wish his name mentioned in any way, because it might injure his prospects with his employers. That was the only case.

Q. He was not a superintendent?

A. No, sir; a miner.

Q. A common miner?

A. Yes, sir. But I don't know that he was a common miner. He was either a common miner or a foreman.

Q. What was your judgment as to the manner in which the mines were worked there? Did anything suggest itself to your mind that would be an improvement upon the present mode of working the mines?

A. Well, yes, sir. We thought of several matters that might be improved upon.

Q. What were they, general?

A. We thought that compressed air could be used to advantage and with economy in working in the drifts and shafts, and that lower stations might be established, and engines run by compressed air sent down from the surface, thus very much increasing the economy of working and prospecting in the mines.

Q. Could that be done as well with as without the tunnel?

A. Yes, sir; I think it could.

Q. Aside from that, are the mines intelligently worked?

A. They appeared to be.

Q. What kind of energy is displayed in the working of the mines and prospecting for ore?

A. I should say very great. They appeared to understand their business, and to be working for the purpose of making just as much money for their different companies as they possibly could. In those mines where they were getting out ore they were making everything jump. They were taking out of the Crown Point, for instance, 250 tons a day with hemp ropes.

Q. This report of Captain Day has been criticized. I think very likely some members of the committee may have been misled. Look at page 28 of the report. I will get you to state, so that it may go down in the written testimony, what Captain Day says is the actual cost of the construction of the shaft from 720 feet to 1,002 feet, being 282 feet, the total advance. What is the total cost per foot?

A. Total cost per foot \$74 31½.

Q. While you were there did he profess to know anything about the cost of any other portion of the shafts than that upon which he reports?

A. No, sir; I understood him to give the data that he professed to know was correct from his own knowledge.

Q. Do you know how long he had been superintendent of that mine?

A. No, sir; I think not long, however.

Q. Did you understand from him whether he ever sunk that distance or not—that 282 feet?

A. That was what I understood.

Q. That was what he himself had sunk?

A. Yes, sir; that is about a year's work.

Q. Well, now, suppose the company had levied the assessments spoken of by Mr. Sutro the other evening, and expended the money claimed by him, would that change your opinion of the correctness of this statement of facts by Captain Day?

A. No, sir; the items of cost are given clearly, with the amounts for each.

Q. You don't know how much money has been expended in litigation, do you?

A. No, sir.

Q. Did you learn anything while you were there about the cost of lawsuits in early times?

A. Yes, sir; I heard them talking generally about the large sums expended in lawsuits.

Q. You heard amongst other things, I suppose, about importing Professor Silliman out there to testify in cases?

A. Yes, sir.

Q. Well, I suppose you know there may be large expenditures in a mine in that country, where titles are uncertain, and where there are adverse claims of title to the same property, outside of the mere sinking of a shaft, or running of a drift?

A. I believe that is given in King's report.

Mr. SHOBER. You mean outside expenditures, General?

Mr. FOSTER. All the items of expense. It shows that very clearly.

Mr. SUNDERLAND. I wish you would find that, General, if you can.

Mr. FOSTER. Here is the Savage mine. I can give that.

Q. Just state it.

A. This gives the cost for three years, 1867, 1868, and 1869. Will the last year be sufficient?

Q. Yes.

A. It is this:

"Cost of officials.....	\$22,123 83
Extracting ore.....	158,675 75
Materials for extracting ore.....	53,406 61
Prospecting and dead work, labor.....	34,838 00
Prospecting and dead work, materials.....	23,394 31

(This is on page 153.)

Accessory work, labor.....	79,398 62
Accessory work, materials.....	50,914 86
Improvements, labor.....	7,105 50
Improvements, materials.....	9,426 00
Total cost of mining, labor.....	297,141 70
Total cost of mining, materials.....	157,141 78"

Then come the incidentals:

"Assaying ore.....	\$3,528 19
Assaying bullion.....	8,740 82
Surveying.....	1,850 00
Office expenses.....	1,157 60
Exchange.....	3,254 70
Housekeeping.....	2,843 15
Legal expenses.....	2,200 00
Taxes.....	19,486 73
Sundries.....	3,017 19

Making the total cost of production..... 480,361 86"

That is for the Savage mine. The Hale and Norcross is given on the other page.

Q. Well, that will be sufficient. I wanted to show that there are other expenses than sinking a shaft. There was some question made as to the accuracy of the estimate here for the cost of raising ore, on the basis of raising 216 tons a day. It is on page 29. It is 216 tons, 1,750 feet, 29 $\frac{6}{10}$ cents a ton. Is there anything in that report of Captain Day to show that that is anything but a mere estimate. Is that stated to be the actual cost of raising ore from that mine, or did you so understand it when you were there?

A. This report was made to us after we left. In considering it, we at first took the idea that that was the actual cost; but, upon looking at it again, we saw at once what it was: that it was intended to be an estimate only.

Q. An estimate of what it would cost?

A. What it would cost under the circumstances stated here.

Q. If he had that much ore to raise?

A. Yes. And not the actual cost of anything they were

getting out of the mine. The items of expense are given there. They comprise the wages of the engineers, firemen, and wood haulers, the cost of wood and materials, and the interest on machinery, and the wear and tear of machinery.

Q. What do you think of that estimate now, not only from that report, but from what you saw at other mines, and from what you learned of the cost of raising ore where there is that quantity to be raised from the mines?

A. I think, if the ore is hoisted in the way he describes, by using a double cage, one going up while the other is going down, under the circumstances he sets forth, it is a fair statement, as far as I can judge.

Q. On page 30 he gives the actual cost of pumping from the 700-foot level?

A. Yes, sir.

Q. With the items of expense?

A. Yes, sir.

Q. Have you any reason to doubt the accuracy of that report?

A. No, sir. I have looked those items over carefully, and the amounts put down beside each, and I think they are fair and reasonable. I think it would cost as much as stated.

Q. He states as a fact that that is what it costs, that that was the actual cost?

A. The prices are reasonable. The statement bears upon its face every indication of being truthful.

Q. On the same page he gives you the decrease of water from June, 1870, to May, 1871. What was the information that you derived while there of the decrease in the quantity of water in descending in the mines, generally?

A. It was reported to us while we were there, and also was stated in their reports that we received afterwards, that, as a general thing, as you went down the quantity of water steadily diminished, and in some mines it had entirely disappeared and the mines were dry. The only water that was in some of these mines was what they call seepage

from above: in other words, the percolation of the surface water down the shafts.

Q. From your information as to the decrease of water in going down, is there anything unreasonable in the statement of Captain Day, that in twelve months the water decreased from eighteen inches to seven?

A. No, sir; there is not.

Q. Did you ever observe, General, a well in the street, at the upper end of Gold Hill, just at the right in going down from Virginia City, just above where the mines have been worked, not quite so far from the west as where they were worked on top, but pitching to the east, so that they must necessarily have been worked under the well? Did you not observe that well while you were there?

A. No, sir.

Q. Do you know, or did you learn, while you were there, as to what retained the water. First I will ask, in your opinion where does the water found in the Comstock come from?

A. It is apparently surface water, and the water seemed to be held near the surface.

Q. By what?

A. By means of clay seams intersecting each other, and forming bowls or reservoirs. In these bowls or reservoirs the water was held, and it was only when these reservoirs were tapped or penetrated, that the water ran out into the mines.

Q. Then, when a reservoir is exhausted?

A. They find no more water until they tap another one.

Q. I understand you to say that these come less frequently as you descend into the lode?

A. Yes, less frequently and of less magnitude.

Mr. SHOBER. Was the quantity of water in these bowls large?

A. Yes, sir; very large in some cases, taking days and weeks sometimes to free the mine from the water that would pour in. It would defy the pumps for a long time, but eventually the pumps would get ahead, and finally

clear the mines entirely. That was the case in the Savage and Hale and Norcross.

Mr. SUNDERLAND. In criticizing the accuracy of Captain Day's report, Mr. Sutro read an extract from that report, on the 26th page, in reference to taking the men in through the tunnel. He says:

"We have, to begin with, (page 19, Sutro tunnel,) 3,000 miners to carry to and from their work an average distance from the mouth of the tunnel of four and a half miles."

Now, that tunnel comes in nearly at right angles to the Comstock, does it not?

A. Yes, sir; nearly at right angles.

Q. I understand the idea to be, that there is to be an endless chain here, to which chain is to be attached cars to carry the men in?

A. Yes, sir.

Q. Do they go beyond the point of intersection of the tunnel and the lode?

A. Yes, sir.

Q. How are you going to get round here a mile and a half or two miles below?

A. Oh, they can easily carry the endless chain any distance, or they can have other chains to take up.

Q. Well, now, when you get your men in here at the end of the main tunnel, half of them will probably want to go north and half of them south. How are you going to distribute them?

A. Well, that is a detail that I haven't thought of. I don't know what their idea is, but that could be arranged by having two stationary engines here, one to run this portion and one to run that portion, and then a third one at the mouth to run the cars on the straight course.

Q. Well, then, when you get in here, that would necessitate the stopping and changing of course?

A. No, sir. They can run them right along.

Q. They cannot run both ways?

A. Well, the chain runs up that way and comes down this.

Q. I understand that. But for the branches you have to have another chain?

A. The track will carry the cars right round. The brakeman will let go the rope here, from the leading car, which carries the train, and the momentum will carry it round so that he can catch hold of that rope.

Q. Then what do these men do that go up here two miles?

A. They must have a switch here, and they will switch off. Certain cars must go one way and certain cars the other. These rear cars switch off, and they have less speed, so that they can change the speed in time to turn them in there in order to go their way. I think that could be arranged.

Q. Well, then, when they get in here, suppose they get in without changing cars at all. They get round here to this point, [indicating on map.] There are several mines along here where they have got to stop.

A. Yes, sir.

Q. Then they have got to get in a cage, and either go up or down to get to the point where they have to work. Don't you think that would take a longer time than to go down the shafts as they do now?

A. Yes, it would take longer. It wouldn't take much longer. It would take them, probably, to go five miles, thirty minutes.

Q. Well, we must remember that there is but one opening where all the miners have got to get into the Comstock, whereas, as now worked, each mine has its own shaft to let its men down in.

Mr. SUTRO. Will you please let the General answer your question, Mr. Sunderland?

Mr. SUNDERLAND. I always give him time enough. I certainly don't mean to go on without it. I thought he had answered.

Mr. SUTRO. Your question was about one entrance to the Comstock, and the General made no reply to it.

Mr. FOSTER. What was the question? I didn't understand.

Mr. SUNDERLAND. I merely remarked that, going through the tunnel, there was but one aperture through which you could get into the Comstock.

A. Only one.

Q. As matters are now, you get down into every mine through its own shaft?

A. Yes, sir.

Q. Do you think that it costs the mining companies, to lower their men, twenty-five cents, or twenty-five cents to hoist them out of the mine?

A. No, sir.

Q. Does it cost three cents?

A. We estimated that it would cost more than that. We estimated that it would cost eight cents. That was upon the supposition that ten men went down in the two cages.

Q. On a double cage?

A. On a double cage.

Q. Now, I get it up to twice that many going down?

A. I am not sure that more could not go; but when I went down there were only five on a cage, and we were pretty well crowded.

Q. Well, now, in taking timbers in, the charges allowed, under this contract, are twenty-five cents a thousand, giving the number of cubic feet as I read you this evening—I mean a ton. Does it cost anything like that to lower the timbers at present?

A. I should think not. I don't know what the cost is, though. I should think not.

Q. Well, it requires no power to lower a cage down, does it?

A. No, sir. The power is exerted to check its velocity, and prevent its going too fast. No, sir; I think timber can be lowered at the rate of ten to twelve cents a ton by the shafts of the mines.

Q. You were asked here whether it would cost as much

to float timbers down the Carson river to the mouth of the tunnel, or to a point opposite to the mouth of the tunnel, as it does to take them to Virginia City and Gold Hill, as they are conveyed there now. I will read you the question :

"Q. Do you think, General Foster, that it would cost as much to deliver timber from the mouth of the tunnel, by floating it down the river, as it would to carry it from Virginia City?

"A. No, sir.

"Q. Mr. Day says it would cost more, because it is farther off. Do you know at how much less cost it could be delivered at the mouth of the tunnel than at Virginia City?

"A. No, sir; I do not know. Just as much cheaper as floating timber down is cheaper than carrying it on a railroad."

Q. Do you know, General, whether it has been done—floating timbers down the river?

A. It certainly can be done, if a flume is prepared for the purpose, and the canal extended directly to the mouth of the tunnel.

Q. With the present obstructions in the river, is it possible to float any timbers down at all?

A. Not as the arrangement is now; no, sir.

Q. Then, before timbers can be floated down there, it would be necessary to acquire a title to that property along the river of the men who have a right to and do obstruct the river?

A. Well, it would be necessary to provide a water flume of some kind.

Mr. SESSIONS. Outside of the river?

A. Yes, sir; outside and parallel to it. Whether that would involve the getting of titles to the water privileges I am not able to say. But a water flume would have to be provided.

Mr. SUNDERLAND. And in order to make a flume outside of the river, you must take so much water from the river and the mills that are there now?

A. Yes, sir.

Q. The chairman of the committee, the other evening, asked a question, which presupposes the existence of a certain state of facts on the Comstock, amongst which was

considerable ignorance on the part of everybody living out there; and I want to have your opinion about it:

"In a geological point of view, as a question of national importance, to determine the richness of the mines and to pursue a systematic method by which that can be attained, and cut off these experiments that are making in a fugitive manner, owing to limited capital, lack of experience, organizations fraught with jealousies, and perhaps a lack of skilled labor, would it not be of very great advantage to the country and to the world to determine the richness of these lodes at a great depth at the national expense?"

Now, in the first place, I want to ask you if experiments upon the Comstock are made in a fugitive manner?

A. Well, not apparently at this time; the mining is pretty systematic there now.

Mr. SESSIONS. What do you mean by "fugitive?" In what sense is that word used?

Mr. SUNDERLAND. It was used by a member of the committee.

Mr. SESSIONS. Did he intend by it that it was mere guesswork, at hap-hazard?

Mr. SUNDERLAND. I suppose so.

Mr. SESSIONS. I recollect the expression he made.

Mr. SUNDERLAND. "Owing to a limited capital." Did you see any evidence of a want of capital on the Comstock for working, or making any necessary improvements for forwarding the interests of the mine owners?

Mr. FOSTER. No, sir; I saw no evidence of any want of capital.

Q. On the contrary, did you not see every evidence that all the capital required was to be had? Next, "lack of experience." Did you see any want of experience by men who were in charge of the mines?

A. No, sir. They appeared to be thoroughly competent and thoroughly versed in the business, as far as I could judge.

Q. Men who had been engaged in mining, I suppose, generally, for some years, were they not?

A. Yes, sir.

Q. "Organizations fraught with jealousies." Do you know of any jealousies existing there between different organizations, or between different individuals, that have

interfered with the effectual working of any of the mines?

A. Well, I can't say that I do, or that I heard of any.

Q. There are jealousies, I suppose, everywhere; but I want to know whether those jealousies interfere with the effective and effectual working of the mines?

A. No, sir; I cannot say that I know of any case in which we heard anything of that kind while we were out there. We heard of strifes for the possession of the stock of different mines——

Q. As a matter of course.

A. And of mine owners, but I do not know that they interfered with the effective working of those mines.

Q. Was there any lack of skilled labor there?

A. No, sir. There was the greatest abundance of that.

Q. I will read now from a speech of Mr. Sutro, which you have attached to your report, on page 64:

"The tunnel, they know full well, is the key to this mountain and these mines, and will and must control and own this whole district. If that tunnel is constructed by third parties, their monopoly will be utterly broken up and ended."

Now, upon the next page I will read you a short extract, the second paragraph from the top:

"Rouse up, then, fellow-citizens. You have no Andrew Jackson among you to crush out the bank which has taken your liberties, but you have the power within yourselves. I do not mean to incite you to any violence; I do not mean to have you assert your rights by riot, force, and threats. That would be unwise, unnecessary, and would only recoil upon yourselves. But I do mean to say that you can destroy your enemy by simple concert of action. Let all of you join in together to build the Sutro tunnel; that is the way to reach them. They do already tremble lest you will act; they know you will form a great moneyed power, and that you will own the mines: they know it will cement you together."

I will ask if you heard, while you were there, the utterance of any feeling to be compared with this?

A. Well, I don't know exactly what you mean, whether you mean the feeling of antagonism?

Q. Yes, sir; such jealousies by one mine toward another, or by any body against the mines, or the men who were working the mines?

A. No, sir. We heard no violent sentiments of that kind uttered. This appears to have been aimed against the Bank of California.

Q. And the owners of the Comstock mines?

A. No, sir; we heard no violent sentiments uttered against either the California Bank or the owners of the mines.

Q. You know there are mines there owned by parties who are not in concord with the Bank of California, don't you?

A. Yes, sir.

Q. Are they equally opposed to the construction of the tunnel upon the terms proposed as the friends of the bank?

A. Well, I cannot say that they are equally opposed. I would hardly like to say that.

Q. Are they opposed to the construction of the tunnel upon the terms proposed, the payment of this royalty and other charges?

A. Yes, sir; they were opposed to it upon the grounds of the payment of the royalty. That appeared to be the great objection with parties who seemed otherwise to be friendly to the tunnel project.

Q. On page 33 of the report is the cost of raising water in the Gould and Curry mine, the statement of General Batterman:

"The cost of raising the water in this mine from a depth of 825 feet, also running pump while sinking to 1,300-foot station, has been \$60 per day, the quantity of water raised about 3,500 gallons per hour.

"The capacity of the pumps is 6,500 gallons per hour. I estimate the cost of pumping from a depth of 2,000 feet, working pump to full capacity, at \$83 60 per day. This estimate includes wood, engineers, fireman, pitman, &c. From this estimate of cost should be deducted the value of the water."

Then he goes on to give the actual cost of pumping per year, and the value of the water sold. Have you any reason to doubt the accuracy of that statement?

A. No, sir.

Q. Has not General Batterman a great deal of positive character in him?

A. Yes, sir.

Q. Is he not reputed to be a very reliable man out there?

A. Yes, sir; very reliable and accurate, and his books, as far as we could judge by casual inspection, appeared to be well kept.

Q. Speaking of books, I don't know whether I asked you or not, but I will now: Did you apply to any body, to any superintendent or clerk of any mine there, for access to any books?

A. Yes, we asked to look at Mr. Batterman's books; at Colonel Requa's. They were shown us. And General Wright, Major King, and Professor Newcomb looked at them, but not in the thorough way that would be necessary to examine them and make detailed statements. I looked also at Colonel Batterman's books, and they appeared to be very detailed, containing the different expenditures under different heads.

Q. The cost of pumping?

A. Yes, sir.

Q. The cost of raising ore?

A. Yes, sir.

Q. The cost of timbers?

A. Yes, and prospecting, accessory work, dead work, and all those heads similar to what I have read in that report.

Q. So that there would be no difficulty, then, in ascertaining the exact amount of the cost in pumping from the works of any company?

A. I should think not. No, sir; no difficulty at all.

Q. Nor the cost of sinking a shaft?

A. No, sir; ought not to be. Every penny appeared to have been entered under the appropriate head, whether expended for labor or materials.

Mr. SUNDERLAND. I believe I think of nothing else now to ask the General. Some questions may occur to me; if so, I will ask the chairman to permit me to ask them.

Mr. SHOBER. I would like to ask one question. How deep was the deepest shaft into which you went?

A. It was a little over 1,700 feet below the initial point.

Q. Did you go to the bottom?

A. No, sir; we did not. They had not the arrangements perfected for going down in the incline. We could have climbed down, but as it was 400 feet down on this

incline from where we went, 1,100 feet, we did not go to the bottom of it.

Q. What was the temperature as low as you went?

A. The temperature in the Yellow Jacket was about 104° and 105° at 1,100 feet depth. In the Crown Point it was 93° and 94° , the difference being caused by the draught which comes down the Crown Point and through into the Yellow Jacket. The water, the rock, and the air showed by the thermometer almost the same temperature at the same points. We tested it. We went to some of the headings where the temperature was 110° .

Q. Did you ascertain at what rate the temperature rises as you descend?

A. We tried to get at that pretty closely. I did not so much as Professor Newcomb, who had a good thermometer with him. We tried it all the way down. As far as we could get at it the rise was an increase of 1° in heat for every 55 feet of descent. We were inclined to believe the statements that at the lower depths it was a little larger increase; that is to say, it would be 1° for every 54 feet, and eventually for every 53 feet as you go down. It has been estimated by English officers that according to that rate 4,000 feet in depth would be the limit at which men could work.

Q. At that rate what would be the temperature at the tunnel level?

A. In a well-ventilated shaft, like the Crown Point, it would be about 97° or 98° .

Mr. SUTRO. Mr. Sunderland, have you closed?

Mr. SUNDERLAND. I said so.

Mr. SUTRO. Well, sir, I believe I won't go into any re-cross-examination, but will rest now with General Foster.

Mr. SESSIONS. Have you any more evidence to introduce to-night?

Mr. SUTRO. None to-night. I am told the other commissioners will be here either to-morrow or next day.

Mr. SESSIONS. Have you anything further, Mr. Sunderland?

Mr. SUNDERLAND. I have not.

Mr. FOSTER. There was one point, Mr. Chairman, on which I desire to be informed. I do not know whether the committee expected me to make that calculation that was spoken of last night or not.

Mr. SUTRO. It isn't material.

Mr. SESSIONS. If the parties do not wish it, I wouldn't like to put you to the trouble, General.

Mr. SUTRO. I suppose General Foster's testimony will close, then, with this meeting.

Mr. KENDALL. I would like to ask one or two questions of General Foster before we close his examination. First, General, I would like to ask this question: What would be the effect upon the Comstock lode and the proceeds of mining operations there if there should be erected at the mouth of this tunnel reduction works, upon the model of those that are most perfect in Europe, for the purpose of reducing ores upon a cheap scale and in a thorough manner? Please state fully your views and opinions upon this question of reduction works of that kind if they should be erected there, and their effect upon our mining interests in that part of the country.

A. I can hardly give an idea as to the effect, although I have an idea that reduction works properly constructed would stimulate mining in that section, whether constructed at the mouth of the tunnel or not. We regarded the construction of mills and reduction works at the mouth of the tunnel as an absolute necessity, to carry out this project to its full perfection. If these be not erected the project will be a failure. To carry the ore from the mouth of the tunnel to the present mills would make it cost so much as to be ruinously expensive. It wouldn't answer at all. The ore now, as it is raised through these shafts, is carried to the mills by a down grade. To reach those mills at the mouth of the tunnel will be either through a sandy soil or a dead level or up hill, and in winter the going up hill would be out of the question. Transportation, therefore, from the mouth of the tunnel to the present mills, is not

to be thought of. So, for a complete carrying out of this project, the mills must be at the mouth of the tunnel. There reduction works should be constructed, so as to simplify and cheapen the process, if possible. Unless that is done, the project cannot receive our recommendation at all.

Q. Do you consider the erection of such works upon a large, complete, and perfect plan desirable to facilitate mining operations in that part of the country?

A. Yes, sir.

Q. Why so? State fully, if you please, your reasons.

A. I mean yes, if it can be clearly ascertained that they can be established with an economy in the reduction of the ores. That is not yet fully established. We don't pretend to report upon that. We only report what we have heard. We don't vouch for the truth of these statements at all. If we had had time, and had been directed to go to Germany and England, we could have obtained statements there that would have enabled us to assert more positively in regard to this thing; but, as it is, we do not know whether those statements are true or not, whether that economy that they claim can be attained in this country, on account of the high cost of labor. If a commission should go to Europe and come back, and report that it would be economy to introduce the system, there is the place, above all others, where mining is most expensive and extensive, to construct these reduction works.

Q. Is the difference in the price of labor the only thing that throws a doubt upon this question?

A. The price of labor and all materials in this country are the great obstacles. The price of materials is as much enhanced, and perhaps more so, than the price of labor. I do not pretend to say that operations could be cheapened here to an extent that would warrant the erection of great reduction works; but, if it be clearly ascertained that such be the case, it would be of great value, I think, to that industry to have the experiment tried. Now the ores from the Emma mine, I think, are sent to England for reduction. Well, there is the transportation, which is an

absolute loss, because, if reduction works were made in this country similar to those at Swansea, that could be saved to the country.

Mr. SHOBER. Are the ores shipped in that way ground up?

A. I believe not, sir. They select the ore they send, and send only the richest.

Mr. KENDALL. Is there not great waste attending such operations as that?

A. I can't say. I never witnessed the operations. I only know it from reports. They send the ore as ballast usually, when they have an opportunity. No; there wouldn't be much more than there is in coal, I should think.

Q. Well, I mean the waste in this way: the necessity of selecting the very richest ores to ship, and then a great quantity of the lower grades being thrown aside as worthless. There would be great waste in that way, would there not?

A. Yes, sir.

Mr. SUNDERLAND. To explain these answers I would like to ask one question: Cannot those reduction works be erected just as well on the Carson river now, with accessibility to the railroad, as they can at the mouth of the tunnel?

A. Yes, sir.

HEARING ON FRIDAY EVENING, FEB. 23.

Mr. SUTRO. I desire, now, Mr. Chairman and gentlemen of the committee, to proceed with the examination of Professor Wesley Newcomb, and first I wish to ask a few general questions in regard to the observations of the commissioners. Professor, would you be kind enough to give us a description of the Comstock lode?

Mr. NEWCOMB. That description has been given so often, I hardly think it will be worth while. You have diagrams here. Do you refer to the lode itself?

Q. Yes, sir; the location—the peculiarities of its location.

A. Virginia City and Gold Hill are located upon the lode. The croppings of quartz rock are above the city a distance of some hundreds of feet, on Mount Davidson. In the first place, this descended to the west, it is represented, for about a hundred feet in depth, (some say 200 feet; that didn't come particularly under my observation;) then it diverted from its course, and changed, so as to glide off to the eastward, going directly under the city. The whole extent of it is almost five miles—said to be; and there are workings in various parts. It has been worked the whole extent; and I don't know but what places have been taken up beyond it.

Q. Professor, would you please state to the committee what is your opinion about the character of the Comstock lode, as far as its continuance in depth is concerned?

A. There is no reason that can be given why it is not a true fissure vein. The material of which it is composed is mostly quartz, with what are technically called "horses" among miners; *i. e.*, the falling of portions of the hanging rock; in some places propylite or porphyry in the vein matter.

Q. What is the mode of working these mines at the present day?

A. By shafts ; mostly by elevating the ore to the surface, and carting off to the mills.

Q. In working these mines, have they passed by a large quantity of ore that it doesn't pay to work under the present mode ?

A. From representations of the parties in connection with the mines, yes. I asked the superintendents the question particularly, and, with one exception, they all represented that there were immense bodies of ore there ; they did this in their reports, especially the Chollar Potosi. They are in hopes the time may come when the cost of labor and the mode of reduction will be so cheapened, that they will be enabled to work the vast bodies of ore remaining in their mine at a profit—ore which they pass by at the present time.

Q. Did you, in your investigations, examine into the character of the country through which the tunnel will pass, to see whether there are any other lodes which it would cut ?

A. Yes, we examined some mining interests where they are partially opened and being worked : one that was said to be upon the Great Flowery and another upon the Monte Cristo lode.

Q. You say on the Monte Cristo lode ? Did you particularly examine it ; I believe you visited the Occidental mine ?

A. I visited the Occidental mine and the Occidental mill, and examined them rather particularly.

Q. Did you go into the Occidental mine ?

A. Yes, sir.

Q. Have they any ore there that would, under certain circumstances, pay for reducing ?

A. They were not at work upon it at the time we were there, in consequence of some difficulty. It had passed into new hands, and they had not commenced operations. The parties purchasing it have confidence that it will be profitable to work more or less of it. They work by tunnels in that mine. The tunnel they use is in 1,850 feet. It has

another tunnel connected with it above. The upper tunnel we did not examine. It was the lower tunnel only that we passed into. We found a current of air passing out quite strongly through the lower tunnel.

Mr. SUNDERLAND. From what direction?

A. It formed a communication between the upper and lower tunnels, and the air passed in at the upper and out at the lower.

Mr. SUTRO. Did you visit any mine on the Flowery lode?

A. Yes, sir; we visited a mine that was said to be upon that lode, (I suppose there can be no doubt about it,) where there was a vast body of croppings that they had cut through and were engaged in working; it was more like surface digging. They had also penetrated the mountain in various places, running in shafts I don't know how far.

Q. Was that the Lady Bryan mine?

A. That was the Lady Bryan.

Q. Was there a large quantity of this low-grade ore at that mine?

A. It was not difficult to determine this fact, because there was a small-sized mountain on it.

Q. Do you recollect what the estimated value of that ore was?

A. I asked the superintendent of the mine that question. He answered it with some hesitation. He said he thought the whole mass would assay \$8 a ton. They were selecting the ore and using the best, collecting but a few tons a day; I think it was four or five tons a day were all they got. They had some ten men only at work.

Q. Could that whole mass be reduced under the present mode of working and with their facilities for reducing the ore?

A. Not with profit, sir.

Mr. SUNDERLAND. I know something about that. I spent some money to try it myself.

Mr. SUTRO. It could not be done under the present method of working.

Mr. NEWCOMB. No, sir.

Q. Professor, what is the main necessity for the profitable and thorough concentration of ore?

A. Proper machinery and abundance of water are the two essentials.

Q. Have they an abundance of water at Virginia City for the purpose of concentrating their low-grade ores they get from the Comstock lode?

A. There was great complaint of the want of water when I was there. No, sir; there is not sufficient water.

Q. To reduce and concentrate the ores properly, it requires a great deal of water, does it?

A. There is a great waste of water necessarily.

Q. Water is the first condition?

A. Yes.

Q. An abundance of water?

A. That is, with this quality of ore. There are certain ores which require no water, because you reduce them with heat. For instance, there is the argentiferous galena, which requires an entirely different operation.

Q. That process is not applied there?

A. No, sir.

Q. All the processes are by amalgamation, I believe?

A. All by amalgamation that I ever saw there.

Q. And that requires a great deal of water? Have you any idea how much it is worth an inch in Virginia City, per month?

A. Well, I have heard it is some fabulous sum, more than they paid for it in California before the present rainfall.

Q. Would there be a supply of water for concentrating purposes at the mouth of the tunnel, from the water which issues from the tunnel itself?

A. I think not, sir.

Q. Could a sufficient amount of water be supplied by bringing Carson river in a flume to the mouth of the tunnel?

A. It could, if the water were utilized. I doubt whether it could be at all seasons of the year, without constructing

a dam and holding it in a reservoir. By holding it in a reservoir, it might be accomplished.

Q. The facilities for reducing and concentrating ores would be much greater at the mouth of the tunnel than at Virginia City, would they?

A. Yes, with a plentiful supply of water.

Q. Have they any supply of water on the cañons where these mills are now located?

A. There isn't a sufficient supply. They are all under the necessity of keeping some water.

Q. The supply is very limited?

A. The supply is very limited.

Q. Does the water flow from one mill to another down the cañon, and is it used over and over again?

A. It is used many times over and over again. Sometimes it is pumped up, after settling, to be re-used.

Q. After passing through a mill the water becomes very muddy, doesn't it?

A. Yes. But after awhile it settles, and they take up the clear water to be used again.

Q. Still there is a scarcity of water, which is absolutely necessary in the reduction of the ores?

A. There was when we were there.

Q. Would there be any space at any of these mills, as they are located in a narrow ravine, to erect extensive reduction works or concentrating works?

A. I do not know of any place where there is room.

Q. In the ravines I am speaking of?

A. No; I don't know of any.

Q. Then it would be quite impossible to erect that kind of works and run them profitably or rationally without an abundant supply of water and abundant space to move in?

A. Well, perhaps the better mode of answering the question would be to state, that one single process is not sufficient to secure the results desired. The assay of ore is made, and the ore is delivered to the miller. He is required to return 65 per cent. of the assay value. That is the general rule. The balance is understood to be lost,

excepting what may be fished up by different parties as it flows away in the little streamlets that wind their way through the valleys and down toward the Carson. They manage to pick up a small percentage.

Q. Well, how would that be at the mouth of the tunnel, Professor? Is there space enough there to erect mills; and is there a descent towards the river sufficient to have self-acting concentrating works, where the pulp passes from one to the other, without the labor of men?

A. From the mouth of the tunnel there is a direct incline to the Carson river. The fall, within perhaps a mile or a mile and a quarter, amounts to 152 feet, according to the leveling of the Surveyor General. That fall would make it very important with reference to establishing a succession of works. It would be sufficient to give a current, all that would be required for the purpose of effecting this object, and making the process automatic, self-acting.

Q. Then it would dispense, to a large extent, with the labor of men?

A. Well, it probably could be reduced at a very much less expense at that point with a liberal flow of water. I think the entire expense of reduction would be lessened one-half.

Q. What is the fall from the mouth of the tunnel to the river?

A. It is said to be 152 feet, according to the leveling of the Surveyor General.

Q. From the mouth of the tunnel to the river 152 feet?

A. Well, I mentioned 152 feet, didn't I.

Mr. SHOBER. What is the distance, Professor, from the river to the mouth of the tunnel?

A. It is a mile, or, according to some, a mile and a quarter. I should judge it to be fully a mile, if not more. It has been measured. The actual distance can be arrived at.

Mr. SUTRO. According to your idea, then, there would

be no difficulty in the erection of reduction works there on the most extensive scale?

A. Well, you might cover hundreds of acres with reduction works, by carrying the current along the margin of the hills, and using it to any extent desired.

Q. There is a large valley at the mouth of the tunnel, sloping to the river, is there not?

A. Yes, sir. It extends along the hills for a long distance. It appears for a long distance to be flat, but it is a regular descent.

Q. The topography of the country there is very favorable for that sort of thing?

A. I should think it would be perfectly plain to every one that it would be favorable. The location, so far as the declivity—the fall—is concerned, is what would be desired.

Q. How is it about the present mills upon the river? There are quite a number of small mills and some large ones along the river. Have they any space, where they are located, for the purpose of erecting concentrating works?

A. They will have a fall of from 12 to 20 feet from their dam that they can get for reduction, but it would not be long before their fall would be used up.

Q. Are they not crowded into a narrow gorge of the river, right close to the bank of the river?

A. Yes, except in one or two instances, where they have canals leading to them, and that is at no great elevation from the river.

Q. There wouldn't be much chance to obtain a great deal of space there, would there?

A. Not a great deal of surface could be used in that way for want of fall. They could obtain surface enough if the fall were sufficient.

Q. Well, in order to thoroughly secure the concentration of ores, you require a great many successive operations in order to get at it at all?

A. You want, as the German's have done, to apply the

different modes in succession in order to secure the greatest result.

Q. Would it be possible, with from 10 or 12 to 20 feet, to get enough fall to put in a succession of concentrating works?

A. Well, I should think not. No, sir; not to make it automatic. It can be done by again carrying the material up and repeating the operation in that form, but it would be attended with a great deal of labor.

Q. Would you consider it more advantageous to have works on a large scale at the mouth of the tunnel? could it be done cheaper on a large scale, with the advantages of the topography of the locality?

A. Yes, I think ore could be reduced at half the expense it costs now, because you could make your works automatic, and use your water power instead of steam power. The ore ought to be reduced there for \$6 a ton.

Q. How much do they get now for reducing ores?

A. The price varies from \$11 to \$13 a ton.

Q. Does that include the hauling?

A. That includes hauling.

Q. How much is hauling stated at?

A. They call it \$1 a ton for hauling by teams to the nearest point; that is, from the Savage mine. I have the statement of the man who runs the mill for the Savage company. He states it at \$1. It costs \$1 a ton for cartage. They reduce it at \$11 a ton, but the mill belongs to the Occidental.

Q. What mill is that?

A. The Occidental.

Q. That is a mill close by the Comstock lode, the Occidental mill?

A. It isn't a very far distance.

Q. How far distant is it?

A. I should judge it is a mile and a half from the mine. I don't know. The nearest approach I have made to it is to travel over it in the night-time, to see the Pa-Utes dance.

- Q. But you went over it in the daytime also?
- A. Yes, sir. I should think it is a mile and a half, possibly two miles distance.
- Q. How far are the mills on Carson river from Virginia City, by the railroad?
- A. I think they call it 23 miles.
- Q. To Carson City?
- A. Yes, sir.
- Q. Some mills are located nearer to Virginia than those of Carson City, are they not?
- A. Oh, yes; there are mills upon the route.
- A. How much do you take off for taking the ore down to the river?
- A. I don't know what it costs to take down to the river.
- Q. It is stated here, in your report, that transportation, or carrying to the mills, is \$1 50; is that the average cost?
- A. Well, I think on the railroads, in some cases, they carry for \$1 a ton to those nearest, and from that to \$2 a ton.
- Q. Would \$1 50 be a fair average?
- A. It would, perhaps, if you take the Carson river and the mills in the cañons.
- Q. Then milling being at from \$11 to \$13 a ton, \$1 50 off would leave about \$10 50 for milling?
- A. Not very far from that.
- Q. How much do you say ore could be reduced for, provided large mills were erected at the mouth of the tunnel?
- A. You mean by steam or water power?
- Q. By water power.
- A. It ought to be done for \$6 a ton, certainly.
- Mr. SUNDERLAND. Six dollars for reduction at the mouth of the tunnel?
- A. Yes, sir; \$6 reduction at the mouth of the tunnel.
- Mr. SUTRO. Well, that would be a saving of \$4 50 on every ton at the present prices.
- Mr. SUNDERLAND. We do it much cheaper than that now.
- Mr. SUTRO. Here's the way it is stated in the commissioners' report: They give it at \$12.

Mr. SUNDERLAND. It ain't so at all.

Mr. SUTRO. But it gives it at \$12.

Mr. SUNDERLAND. That is what the mills charge. It isn't what it costs. That's what the mills charge the miners.

Mr. SUTRO. Well, that's what the miners pay.

Mr. SUNDERLAND. Yes, sir.

Mr. SUTRO. Reduction could be done at the mouth of the tunnel, Professor, for \$6; is that your statement?

Mr. NEWCOMB. My statement is that it could be done at \$6.

Mr. SUNDERLAND. That is not at a profit?

Mr. SUTRO. That would be a saving of \$4 50 a ton. How much royalty have they got to pay to the tunnel company?

Mr. NEWCOMB. The specifications in the law made are \$2 a ton.

Q. Then, according to that, they would save on milling alone \$2 50 on every ton, besides the royalty?

A. Yes, if you figure right.

Q. According to these figures we have just made?

A. Yes.

Q. If mills were erected at the mouth of that tunnel, Professor, with the present mode of reducing the ore—that is, to crush the ores and amalgamate them, and save the tailings—do you think that, in running those tailings over concentrating tables and concentrating works, a greater saving could be made?

A. I think it is a disgrace to our country that we lose 35 per cent. of the metals.

Q. It is 35 per cent. that they lose?

A. From 30 to 35. Some claim they can make it about 30.

Q. Say about one-third?

A. About one-third. It varies in that respect. In the report of the Savage company they give in one of the mills a different result from that of the Customs mills. The Occidental mill is one of their own mills. They work up the tailings themselves, and they get a better result from the silver and a less result from the gold than at the Customs

mills. In the one case they lose 44 per cent. of the silver, according to the report.

Mr. SUNDERLAND. Do you remember what year that report is?

A. The last report made? I don't recollect exactly; but the statement is made in this report.

Mr. SUTRO. I think it is stated in King's report, very fully, how much they lose. They lose from 35 to 40 per cent. According to that, Professor—

A. I will give you the statement. It is on page 20 of our report:

"The loss in working from the assay value of the ores is, of gold, 25 $\frac{1}{10}$ per cent.; for silver, 34 $\frac{2}{10}$ per cent. The larger the proportion of gold in the ore, the less absolute loss is made in the working.

"The above statement is the result of the workings in the Occidental mill, under the direct control of the Savage company, and includes all savings from slime and tailings secured to the company.

"In the Customs mills the report shows a less favorable result on the silver product, as follows: Gold loss, 23 $\frac{1}{10}$ per cent.; silver loss, 44 per cent."

Q. Well, now let me repeat my question: Could an additional amount be saved by taking these tailings, which come from the mills, and running them over concentrating tables, saving the valuable parts, and then reducing these?

A. I should think it might, most decidedly.

Q. Would you consider that the circumstances at the mouth of the tunnel are favorable to that sort of work?

A. Yes.

Q. Well, if they lose 35 per cent., and the yield is \$15,000,000 per annum, the total result would be about \$23,000,000?

A. That is on the supposition that you make.

Q. I mean the assay value would be \$23,000,000. That intimates a loss of \$8,000,000 per annum. How much additional do you think could be saved by having the most approved concentrating works erected at those mills at the mouth of the tunnel—the per cent. of the gross yield?

A. They work in Europe very much closer than we work. It is reported, upon authority I can give, to be five

per cent.; that is, one of the professors in the mining school in New York so states.

Q. Columbia College?

A. Columbia College. He has recently returned from there. He repeated to me that they were now within five per cent.

Q. Then, in losing 35 per cent., as they do now, supposing they had very complete concentrating works, with an abundant supply of water, how much could that loss be reduced to, in your opinion?

A. I think the loss would be greater than in the works of Europe, because the body of work is much greater. You would make a greater loss, because you would be under the necessity of hurrying up your work more. There the body of ore worked is smaller in comparison, and the results are favorable. More time and attention are given to it than would be profitable here. I think the loss might be reduced to 10 per cent. here.

Q. Then they would save 25 per cent. additional?

A. I think it ought to be worked within 10 per cent.

Q. Then they would save 25 per cent. additional of the present yield, which would be almost \$6,000,000 on the whole amount of \$23,000,000 per annum?

A. I will say that I was very forcibly struck with the mode of reduction, and the extreme loss resulting therefrom. They represented that they had tried every means in their power to correct that condition. The miners, of course, do not wish to lose it any more than any outsiders. They tried various plans for overcoming the loss; and they have their works, in connection with their present localities, as far as it can be done, made, perhaps, as perfectly as they can be made under the circumstances. But they have not the conditions for the succession of works that is required, in order to obtain the desired result.

Q. If it were proposed, Professor, to furnish to these mills on the river the same power at the mouth of the tunnel they have now, would you think it probable that they

would refuse to accept the same at that more favorable point?

A. I can only answer you, sir, upon general principles. I should think that they were very foolish if they did not accept. I know if I were owner of a mill upon the river, and could get the power located where I should not be subject to the expense of keeping up dams and flumes and to freshets, I should very gladly make the exchange. I cannot say what they will do out there.

Q. Then, according to ordinary reasoning, and consulting the interests of themselves, they would not hesitate of accepting a power equal to the power which they hold now, and having it located at that more favorable point at the mouth of the tunnel?

A. It would possess another advantage in addition: they would be permanently supplied with water, which they are now deficient in. When we were there, many of the mills were not working on account of the want of water.

Q. By erecting a large dam, and damming up the water for miles back, would it accumulate in large quantities?

A. Yes, sir. All my remarks were made with reference to a reservoir being constructed sufficient to hold the water that would accrue through the season. The water that passes down in the spring is sufficient to keep the mills going through the whole of the year, no doubt. I have it from good authority that the Mexican mill has been repeatedly flooded, and, in the opinion of the man who was the superintendent of that mill for many years, the body of the water was abundant for everything, if it could be utilized.

Q. Is there much wear and tear in those mills, Professor?

A. Well, from actual observation I couldn't say; but from the representations made to me by the President of the milling company it must be very great.

Q. Who is that, Professor?

A. That is Mr. Sharon.

Q. Who is he? Is he the agent of the Bank of California?

A. He has that reputation. I never transacted business with him in that way.

Q. What did he tell you about the wear and tear of the mills?

A. He very kindly took us to visit the different mills belonging to the company and many others. The number is rather difficult to mention. I have a list running down two or three pages of my note-book. I told him it must be rather expensive keeping those mills up. It is claimed by Mr. Sharon (I am reading from my note-book) that the millions of dollars invested in these mills would be sacrificed should the Sutro tunnel become an accomplished fact. In answer to an inquiry, we learned from him that the expensive machinery used has to be replaced every two years.

Q. In other words, it wears out every two years?

A. He says it has to be replaced. I presume it wears out.

Q. You took that down at the time the statement was made?

A. Yes, sir.

Q. Well, supposing these people would contemplate an exchange for water power at the mouth of the tunnel, and would in the meantime not replace their old with new machinery, would they lose much of anything?

A. Many of the mills were not in movement, for want of water or being out of repair, when I was there. They constantly required these repairs. If they were transferred, and the use of the water power were substituted for steam, I should think that they would be the gainers by the operation very materially.

Q. They could let the machinery wear out? It would take several years to make the tunnel, and by that time they could move their mills, and there wouldn't be much loss, would there?

A. I don't think there would be much loss. The ex-

pensive part of the machinery composes the most of the value of the mills.

Q. What do the buildings amount to?

A. Not a great deal, sir.

Q. What are they made of?

A. Mostly wood.

Q. Boards?

A. Boards, rather loosely put together.

Q. They don't cost much, do they?

A. They are a little better than our ordinary country saw-mills, with one exception—yes, two or three exceptions: where they are constructed with a great deal of care, the timbers well put together. But the most of them, with the exception of the frame-work, are of very little consequence. The frame-work I should not consider of very great value.

Q. Couldn't the frame-work be taken down and removed?

A. It could; but that would be at a sacrifice, of course, to some extent. The Mexican mill is a very excellent mill. There was one very expensive mill belonging to the Gould and Curry; that is now dilapidated, or was when we were there.

Q. It is not torn down?

A. I don't know whether it is torn down or not. The building was standing when we were there. It was a very expensively put up building.

Q. You spoke of Mr. Sharon a moment ago, the agent of the Bank of California. Did he ever say anything to you about being opposed to the tunnel?

A. Well, he expressed himself very strongly when I first saw him in the street in connection with the other commissioners.

Q. When you were introduced to him?

A. He didn't address himself to me; but he expressed himself as very strongly against the tunnel.

Q. On what grounds did he state he was opposed to it?

A. The grounds were not given; only he would crush it, or something of that effect.

Q. Did he make any remark to the effect that he would break it up, or oppose it, or defeat it, if he could?

A. Yes, and in very strong terms. I cannot use the exact words he did, but I know the expression was very strong.

Q. It showed a good deal of feeling about it?

A. He seemed to.

Q. Would you consider that, if Mr. Sharon owned the privileges connected with this tunnel, he would like to construct it?

A. That would be merely a matter of opinion. I could hardly answer the question. I think very likely Mr. Sharon has got money enough, and wouldn't like to bother with it just now; that is my opinion. I had an opportunity of seeing his mode of operating a little in stocks.

Q. How do they make their money there, Professor?

A. Some men make it by hard labor, I suppose.

Mr. SUNDERLAND. If the chairman please, I object to that question, as having no relevancy to this case. It don't make any difference how we make our money there. We make it honestly or dishonestly. It has no bearing upon the tunnel.

Mr. SUTRO. I think it has a very close connection with the tunnel. I am trying to arrive at the motives for the opposition of these people, and, in order to do that, I want to show how these men make their money; whether they made it by legitimate mining or by stock-jobbing. I think the question is very pertinent.

Mr. SUNDERLAND. If we make or lose money by stock-jobbing, I don't think it will make the tunnel of less or greater value.

Mr. SUTRO. Well, if the tunnel would break up this stock-jobbing, it is very natural that these people who make their money by stock-jobbing would be opposed to it; consequently I think the question is pertinent.

Mr. SUNDERLAND. It will be for the chairman of the committee to decide. It only opens the field to all kinds of inquiry that may be made.

Mr. SESSIONS. It is quite speculative; the question is.

Mr. SUTRO. Mr. Chairman, I want to show that these people are opposed to the tunnel for various reasons, one of which is, that they make their money over there, not by legitimate mining, but by bulling and bearing the stocks. If the tunnel comes in, why it opens up all those mines, and they can't hide anything; it becomes legitimate mining.

Mr. SESSIONS. Well, ask the question.

Mr. SUTRO. What is the motive of opposition, Professor, in your opinion?

Mr. SUNDERLAND. I object to that.

Mr. NEWCOMB. I cannot go into the man's motives.

Mr. SESSIONS. Well, what is the manner of the opposition they make, not the motive. How is the opposition made?

Mr. SUTRO. How do they show the opposition to the tunnel, Professor? Do they exercise any influence over the people at Virginia City, in such a manner as to prevent them from becoming interested in the tunnel and seeing it go ahead?

A. Well, we took the evidence of some of the miners in regard to that; one of them particularly specified that he didn't wish to have his name given in connection with it in any way, and in the course of conversation he stated that if the mining ring knew that any intelligence was communicated to the commissioners adverse to what was thought to be in their own interests, and in favor of the tunnel, the parties communicating it would be discharged from employment, and he would not like to have his name mentioned in connection with it. He gave us some little information upon the subject, still further, in regard to the amount of low-grade ores.

Mr. SUNDERLAND. I would like, if the chairman please, to have the name of that man given. I would like to know what position he holds, so as to know whether his information is entitled to respect.

Mr. SUTRO. If the man gave his information, and stated

it would jeopardize his position to have it known, it would be hardly fair to give it.

Mr. NEWCOMB. I would decline to give his name, because I promised not to.

Mr. SESSIONS. It isn't necessary.

Mr. SUNDERLAND. Then, since the witness objects to giving the name, I object to having repeated here anything that that man said, because he may be some loafer, that has a spite against a mine owner, and has given false information. We might prove his character to be such, that his declarations wouldn't be worthy of belief. It is exceedingly strange to give the statement of a man, and then withhold his name, so that we cannot dispute the proposition, or bring into question his veracity.

Mr. SESSIONS. It would be hardly tolerated, of course, in a court of justice.

Mr. SUNDERLAND. Never, anywhere in the world.

Mr. SUTRO. Professor, let me ask you a general question. Did you find, in your intercourse with the laboring miners, that they exhibited any fear of communicating any information to you which would be favorable to the tunnel?

Mr. NEWCOMB. When we visited the mines, we were generally accompanied by the superintendent. There wasn't very much opportunity of conversing with the men, excepting in some few cases with the foremen of particular levels.

Q. Well, from what you saw there, Professor, would you think that these men would have communicated to you any information favorable to the tunnel while their foreman or superintendent was present? What is your impression about that?

A. That's a rather hard question to answer. My views in regard to it, at the time, were perfectly neutral, neither for nor against it; and the influence exerted upon my mind by this man, who seemed to be a fair man, led me not to make examinations. Perhaps it would have been better if I could have done so more extensively. I didn't wish—

Q. You didn't make them, then, because you feared you would injure those people?

A. I didn't wish to do them an injury by holding communications with them upon the subject. This party influenced my mind so far as to lead me to believe that, if we were found in communication with the parties, and they gave us information upon the subject, and it was ascertained, it might result to their injury.

Q. Did you come in contact with any of the officers of the Miners' Union at Virginia City?

A. Yes, sir.

Q. Were they in favor of the tunnel?

A. Yes, decidedly in favor of it.

Q. Are these miners very numerous over there?

A. Well, I don't know how numerous they may be, but the understanding was that they comprised the greater portion of the miners.

Q. Of the laboring miners?

A. That is my understanding.

Q. They number several thousand, do they?

A. Yes. I do not know how many belong to it, excepting that they are very numerous. That is as far as I can say. That was the representation they made to me at the time.

Q. They wanted to see the tunnel go in?

A. Yes.

Q. Did they make any statement why they thought it was desirable to make that tunnel? Did they state anything in regard to their health?

A. Well, they stated that the miners generally were healthy, but it would be an improvement in the mode of ventilation, and it would develop the mines, and prevent, as they represented, gambling in stocks; it would prevent loss to the miners in investing in stocks—the miners themselves.

Q. They lost money by gambling in stocks?

A. Yes.

Q. Professor, what do you know about the condition of

the atmosphere in these mines? Do you consider that it is a healthy atmosphere where these men are employed?

A. In some places, yes. In the Yellow Jacket mine. I don't recollect whether it is the 1,100-foot, or 1,200-foot, or 1,000-foot level where the miners were; but, at any rate, the heat was very great, and the atmosphere was stagnant. It filled my lungs so rapidly as to produce a congestive state, and made it difficult for me to breathe, and that was not in the hottest point. General Wright went in a portion where the thermometer went up several degrees over the heat at that point. I was in Honduras in the same temperature, where they had precisely the same range of thermometer, and no such difficulty followed where we could have advantage of the motion of the air, but the inhalation of the damp air produced a form of congestion that made it very difficult to breathe. The men that were sinking on that level, with the exception of a light pair of pantaloons, were naked, and the perspiration was streaming from their bodies; yet they were very healthy.

Q. Professor, in the reports made to the English Parliament, in investigating the condition of the miners, it has been stated that 42 per cent. of them die of miners' consumption; that while they are at work they get so much accustomed to the place, that they never find out they really have the seeds of consumption in them until it is too late. They then leave the occupation, and go off to some other place to die. Do you think that the condition of the Comstock lode is similar to that?

A. No; I don't think it is, Mr. Sutro. I think the circumstances are quite different. The most of the miners in England are coal miners. I have been in the mines of Newcastle, through that region—the coal mines. There you have a great deal of free carbonic acid in the atmosphere, which has a tendency to affect the lungs very injuriously, I think, nearly as a slow poison; but in our mines we have no accumulation of carbonic acid gas.

Q. Well, haven't we sulphuretted hydrogen gas?

A. Very little of it.

Q. Isn't it very fatal where it does exist?

A. Yes; but it isn't perceptible here at all events.

Q. Do you consider there is a lack of oxygen in the air?

A. No; I think the unhealthiness is due to the stagnant condition of the atmosphere. Give it movement, and the air is just as good in the mines as it is up outside; I don't think there is much difference.

Q. Do you consider that if that tunnel would go in, and connect by its branches with a great number of shafts, that the ventilation would improve; that the motion of the air would improve?

A. There is no doubt that it would improve ventilation. At the same time other appliances could be made to ventilate it.

Q. They could blow in air?

A. They could blow in air, or send in condensed air.

Q. Well, to make condensed air requires a good deal of power, does it not?

A. Yes, sir.

Q. Couldn't this water at the mouth of the tunnel be applied to condensing air, and the mines be ventilated much cheaper than they could be from the surface by steam power?

A. Why, it would make the difference between the inexpensive water power and the expensive steam power.

Q. Would you consider, Professor, that, with the connections from the tunnel, the atmosphere would gradually cool off above the tunnel level, say within one, two, or three years, and become cooler than it is now, by having a thorough draft going through the different shafts up to the surface?

A. Yes, it would cool off gradually.

Q. Then, taking the average of the thermometer as it is given here, at between 90° and 110° , say 100° , would that, think you, be reduced in one or two years down to 75° or 80° by constant ventilation?

A. Yes; If you throw a cold current of air through, of course you can cool it off. That is evidenced very distinctly

in the Hoag tunnel, in passing into the tunnel, directly under the mountain, where the air would be heated but for the condensed air that is thrown in. Why, the mountain is as cool in the tunnel as it is outside, and it is due to that circumstance; and this condensation is made by water power a part of the time, when they can use the water, at other times by steam power; when the water power fails, it is supplemented by steam.

Q. An almost unlimited supply of condensed air could be thrown into those workings from the mouth of the tunnel, provided you have cheap water power to make it by?

A. Yes; an unlimited supply could be thrown in if you have cheap water power. There would be no difficulty about that.

Q. Would you think, Professor, that the thermometer, which now stands at an average of 100° , would then go down, say to 70° ?

Mr. SUNDERLAND. I don't think the Professor has stated that it stands at the average you have given.

Mr. NEWCOMB. I don't think that it is a fair statement, because it is not. In the deep workings they may find the temperature (not in the present working headings, but in those that have been placed on one side) as high as stated. When they are at work they force the air into the headings upon the workmen, and it keeps them comparatively covered; but where we found the temperature to rise to 103° was in a nook, out of the way, where the water was hot, the rock hot, and everything heated, and the atmosphere filled with moisture.

Mr. SUTRO. What would you consider the average temperature of the mines in the headings and the drifts and the winzes of the working mines, say at the 1,200-foot level, so far as your observation goes?

A. We found at the headings of the Crown Point a very comfortable temperature; not particularly hot, at any rate.

Q. What would you call comfortable?

A. Well, a temperature of 80° suits me about as well as

any. I don't like it any less than that at any time, for my feelings.

Q. What would you consider the average of the temperature at the headings at the depth of 1,000 or 1,200 feet?

A. I think it would run up probably to 85°.

Q. At headings?

A. At the headings on the level. It would be very much higher but for the blowers, which keep it cool while they are sending a current of air through their tubular structures to the headings. As you descend the heat will increase. It will increase after passing down 1,000 feet much more rapidly in proportion than for the 1,000 feet above, until you get to the depth of 2,000 feet, and then the increase is still greater.

Mr. SHOBER. What would be the heat at that depth of 1,200 feet, without artificial means of ventilation?

A. Well, it would exceed 100°. I believe it would go up to 105°. It would be just about 105°.

Mr. SUTRO. Wouldn't it go higher than that if there were no ventilation?

A. No, I think not. A person could not live in a temperature of 105° there, when he could live in the open air in a temperature very much higher.

Q. Then there is a difference between the salubrity of a temperature in a mine and on the surface?

A. There is, where you get no motion in the atmosphere. Stagnant air a person cannot stand. A better mode of expression would be, that the sensations are not truly indicated by the thermometer.

Q. Professor, in your opinion would the working capacity of the mines not be increased if the temperature were reduced say 10° or 15° or 20°?

A. There is no doubt about that, because in some of the mines, although they were stripped nearly, with only a pair of pantaloons on, when they were at work the perspiration was reeking upon them.

Q. Did it fill their boots? Did you ever see their boots filled with perspiration?

A. No; I didn't examine their boots.

Q. Well, it is like a steam-bath, a good deal, isn't it?

A. It is a good deal like the bath I took at the steam springs.

Q. Suppose the temperature were reduced on account of the current created, so that the air could no longer be stagnant, would you consider that the working capacity of the men employed in the mine, below the 1,000-foot level would be increased 25 per cent.?

A. To what other depth?

Q. To the tunnel level; from 1,000 to 2,000 feet.

A. Well, I should think it would. The lower the level the more the heat is, and the more difficult to work in the mines.

Q. They state there are 3,000 miners employed on the Comstock lode, at \$4 a day; that is \$12,000 a day. Twenty-five per cent. saved would be \$3,000 a day, which would be the actual saving in labor, equal to \$1,000,000 a year.

Mr. SUNDERLAND. Mr. Chairman, I would prefer that the witness make his calculations.

Mr. SUTRO. I ask the witness whether my statement is correct?

Mr. NEWCOMB. He can make his calculations as he pleases. I don't respond to that.

Mr. SUTRO. It appears in the report as my question. I want the Professor to state whether that is correct.

Mr. NEWCOMB. Well, if your statement of the number of miners, 3,000, be correct, and if you have figured correctly, why that is the amount saved, \$3,000 a day. I don't take the responsibility of the ciphering at all.

Mr. SESSIONS. The data given, we can figure it as well as he can.

Mr. SUTRO. There is \$1,095,000 that could be saved in labor alone. In going below the tunnel level the heat would be still greater, would it not?

Mr. NEWCOMB. I think the heat would be increased about 1° for every 40 feet. It is ascertained that below the 2,000-foot level the increase is very much greater than above the

2,000 feet, the ratio of increase is greater, and as you descend that ratio continues to increase. I think that at the depth of 2,000 feet, if there were no appliances to cool the place, the temperature would stand at 123°.

Q. Would you consider it possible to work the mines below the tunnel level at all, except you introduce condensed air?

A. I don't believe blowers would be sufficient; at the same time that is merely a matter of opinion. I think by condensed air it might be done.

Q. Getting down to that depth, would there not be required a very large power, in order to drive these blowers and condense air particularly?

A. Yes; it would require a good deal of force.

Q. That power could be obtained at the mouth of the tunnel?

A. It would take expensive machinery.

Q. Water power could be applied to that at the mouth of the tunnel. Professor, I want to ask you whether, from your observation, (what you know and have seen,) those mines are worked legitimately for mining purposes, or whether they are worked for stock-jobbing purposes?

A. I think when they strike a bonanza they are worked for mining purposes. But when they do not, they work them in the stock-board in San Francisco.

Q. Do you know of any instance where they had a body of ore they had discovered, where they didn't let the public know? Did you ever hear of any such instance?

A. They struck in the Belcher when we were there.

Q. Did they make it known at once? Did they let the public know as soon as they struck it? Did the public generally get that information at once?

A. I am not aware that they did, but it was known in a very few days.

Q. Was it known the day they struck it? Did the public generally know about the strike they had made in the Belcher mine?

A. We were examining these mills at the time at some

distance off, (I think in the Seven Mile cañon,) and a party came riding on horseback with a very nice specimen, and handed a note to the president of the mill company——

Q. Who was he?

A. He was Mr. Sharon.

Q. He was with you, was he?

A. Well, we were with him. He was taking us out in his carriage, very kindly, to show us the mill property, and we saw that it was a matter of considerable importance to him, and we rather urged him to turn back, thinking that he might be required at his office. He did so, and telegraphed to San Francisco for the purchase of stock of the Belcher company.

Q. Was Mr. Sharon at that time connected as an officer with the Belcher company?

A. I don't know, sir. He told me afterwards that he had secured control of the mine.

Q. Did you ever hear of the miners being locked up in a mine, when a strike had occurred, with their meals sent down to them, champagne and all that sort of thing?

A. Not while we were out there. There is one thing I know pretty decidedly; the miners wouldn't have objected to it, especially the champagne.

• Mr. SUNDERLAND. They never have been found to object to it yet. I don't see what business it is to any body outside either, if the miners don't object to it.

Mr. SUTRO. Do you think, Professor, that these mines are worked in the interests of the men who are the owners of the stock?

Mr. NEWCOMB. Well, if you want my actual thoughts in regard to it, I should say they were worked more in the interests of particular parties, that may or may not be interested particularly in the mines. I have to judge from general observation, and from one and another little circumstance. I had had some little investments in mines myself, and they had been paying regular dividends of \$25 per share, I think, for one year. I got two or three dividends at first, and then I had the privilege of receiving a

notice of an assessment of \$20; and I happened to learn accidentally that they had a large surplus on hand when the assessment was made, and I wouldn't hold such stock. I sold it out at a sacrifice of two or three thousand dollars. The assessment was never paid, that I recollect.

Q. Was that one of the mines of the Comstock lode?

A. Yes, sir.

Q. What is the general opinion of people about the management of these mines?

Mr. SUNDERLAND. I object to the general opinion.

Mr. SUTRO. Professor, what is your opinion of it?

Mr. NEWCOMB. Well, ask the lawyer here. He knows all about it.

Mr. SUTRO. He won't tell us.

Mr. NEWCOMB. Yes, you will; won't you?

Mr. SUNDERLAND. If he puts me on the stand, I'll tell.

Mr. NEWCOMB. Well, I know some men get very wealthy there, and others do not.

Mr. SUTRO. How is it about these superintendents there?

A. They are very intelligent men.

Q. Haven't very many of them grown rich?

A. They have excellent champagne.

Q. They are smart, are they?

A. There are not many smarter men to be found. They are really good fellows.

Q. What chances have they to speculate? Have they made much money as superintendents of those mines?

A. They must have an opportunity of knowing when anything rich is to be struck, and they can easily telegraph to San Francisco and secure stock. They have that advantage, and whoever would be a superintendent and not improve that opportunity, would be behind the common usage. I suppose the superintendents would be considered as rather rich.

Q. Is Mr. Requa reputed to have made much money over there?

A. I am glad to say he is reputed to be wealthy. I hope

it is true. I think Mr. Requa is a very fine gentleman. He is certainly a very intelligent one.

Q. Would these superintendents like to lose a position that is as lucrative as that they hold?

A. Well, if I were a superintendent there, and understood my business, I shouldn't want to lose the position.

Q. Who has the controlling power there which keeps these people in place?

A. It ought to be the stockholders of the mine, of course.

Q. Do you think they are the ones?

A. I can't say. I am not in the ring.

Q. Would these superintendents, if there be a "power behind the throne," be apt to do anything against that power that could remove them from their position?

A. I shouldn't think it would be advisable for them to do it, and I don't think they would.

Q. Mr. Sharon told you that he was opposed to the tunnel?

A. Yes.

Q. Hasn't he the reputation of being the "power behind the throne?"

A. Well, he has the power that wealth gives, undoubtedly, and exercises it. He is a very keen, sharp, bright, active man.

Q. Would you think that these superintendents would be apt to cling to these positions, which are so very lucrative, and not give offense to the parties who have the power to remove them?

A. Well, that would be very natural to suppose.

Q. Are there mines over there owned by any one particularly?

A. As far as I know they are all joint-stock companies, with perhaps one or two exceptions.

Q. Who are the owners of that stock?

A. Oh, they are owned by individuals—farmers, merchants, mechanics, and all classes of people, more or less. I know a great many parties in San Francisco and in various places that own stock.

Q. Do they buy that stock for investment, to keep?

A. Some have done so, I know.

Q. Do they do it nowadays?

A. I don't know.

Q. Have you any idea how much the transactions of these stocks amount to per month in the San Francisco stock board? I mean the transactions of the stock in the Comstock lode?

A. I don't know. I should think millions.

Q. Then, according to that, these stocks change hands from day to day, and new sets of men come into possession?

A. Yes, sir.

Q. And they don't care much about the property, or who controls it?

A. It is the same with the mining stock as with other stocks. Railroad stocks are continually changing in the market in the same way. There is a large amount of stock-jobbing.

Mr. SUNDERLAND. I wish to object to Mr. Sutro's making statements that are not borne out by facts.

Mr. SUTRO. I want to get at the mode of working those mines, whether they are economically worked for the profits, or whether the whole system of mining is a stock-jobbing operation; where one is continually trying to get the start of the other. I want to show that this property is simply a foot-ball; that it is used for speculative purposes; that it is bought and sold from day to day; that new parties are all the time getting the ownership; and that there are certain rings who control the thing.

Mr. SUNDERLAND. Well, there is no law there against buying or selling these stocks, and people will deal in them, and you can't help it.

Mr. NEWCOMB. That is evident, I think; you can't help it any more than you can help railroad stocks being bought and sold.

Mr. SUTRO. You would consider, Professor, that that tunnel would be of great advantage to those mines, as far o

as the drainage, ventilation, and cheap mode of transportation are concerned?

A. Well, it would serve to drain the mines, to save what expense is incurred in the process of draining. It would aid in ventilation, although I do not deem it an essential thing.

Q. It isn't absolutely necessary?

A. Not absolutely necessary.

Q. Still, would it be desirable?

A. It would be desirable to have all the ventilation you can get, and as you go down the increase in importance is very great.

Q. Do you know how many steam engines are in operation on the Comstock lode?

A. I do not. I never counted them.

Q. Have you an approximate idea how many there are?

A. No. I know that a man that is unaccustomed to the noise feels about the same under the Falls of Niagara as he does along the streets of Virginia City to Gold Hill, from the sound of the stamps.

Q. I was not referring to the stamps, but to the hoisting works.

A. I referred to the stamps; the noise made by the stamps.

Mr. SUNDERLAND. That becomes quite musical after a while.

Mr. SUTRO. Yes, they can't sleep without it.

Mr. NEWCOMB. So I am told. I don't know the number of engines. I never counted them. But there is a large number necessarily employed to move those stamps.

Mr. SUTRO. After the tunnel is in and the branches are constructed, and these shafts connected, would there be a necessity for pumping machinery any longer, down to the tunnel level?

A. No, sir; I should think not. There is no reason why there should be, for the simple reason that there would be no necessity for it. The amount of water that comes from near the surface depends very much upon the seasons.

Where the seasons are very dry, the quantity would be less. Where they are very wet, the quantity would be increased.

Q. You visited a number of mines on the Comstock. Did you ascertain anything about the quantity of water they had?

A. Well, we tried to work that water up, but all the information we really had upon the subject, as to the amount, is what we derived from the reports of the superintendents.

Q. Well, I want to ask you whether they haven't stated almost universally that the water in the last year had very much decreased as they descended?

A. Yes; they gave that report.

Q. Are you aware of the fact that there had been three years of immense drought over there; that they had hardly any rain or snow fall during the three preceding winters; that the earth was all parched up; that the wells had dried up; and that, in fact, the water had almost disappeared?

A. I had known that, along the range of the Sierras in the State of California, there had been three successive dry seasons; and I was told that it had extended to Virginia City and the mines.

Q. Would these three seasons not have dried up the earth and prevented the supply of water at the depth these mines had run?

A. It would lessen the flow of water necessarily, because this coming from the surface, and passing into the cracks and crevices of the rocks, and percolating through every formation, would be lessened to a very great extent.

Q. Where does the water come from that is found in penetrating the crust of the earth?

A. Well, the most of it is the result of rain.

Q. That seeps through?

A. Yes, sir.

Q. Wouldn't it be a natural result that, after three dry seasons, the supply of water in the earth would be a great deal less than after a wet season?

A. Yes, it has always been found so.

Q. Well, reports state that the snow fall this winter has

been very heavy—both snow and rain; and wouldn't the result be, that after the snow melts a larger quantity of water would be found in the mines than there had during the last year?

A. Yes, I should judge that that would be the case. That was the opinion I expressed to the commissioners, that the lessening of the amount of water was due to that cause.

Q. What time were you in Nevada?

A. I think it was in August.

Q. August of last year?

A. Yes.

Q. That was almost the driest part of the year, was it not?

A. It was so dry, that there was a great scarcity of water, at any rate.

Q. I find it stated here, in the report of the Surveyor General, on page 45:

"I would state that the amount of water flowing into the Carson river this year is extremely small, far less than ever known since the settlement of the State; and it is not probable that a similar reduction will happen in many years. I have, therefore, based no estimate or calculation upon this year. For the months of August, September, and October, and up to the present time, the flow has only been 25 cubic feet, on a grade of 10 feet to the mile."

In another place he states, that

"The average flow of water in the Carson river is $508\frac{1}{100}$ feet."

That would show that the quantity of water in the Carson river this year was only $\frac{1}{20}$ of the average flow of ordinary years. Well, taking that as a basis, would it not appear that some very extraordinary dry seasons had occurred in Nevada?

A. Oh, we have the fact, I suppose, without a doubt.

Mr. SUNDERLAND. It isn't contended that we have had three dry seasons there. I don't deny that. I have been there all the the time, and know it.

Mr. NEWCOMB. I have seen, after a blow from the pick, the dust fly from the vein.

Mr. SUTRO. While you were there, did you enter the Savage mine, or the Hale and Norcross?

A. No, I did not.

Q. Why did you not?

A. Arrangements were to have been made by the superintendent to admit us into the Savage, but, in the first place, they were flooded with water; they had struck what you might call a bonanza of water, and the water swept out into the Hale and Norcross. The arrangements were to have been made. We expected to go into the Savage mine, but the shaft was out of order.

Q. Why couldn't you go down the other mine; they were connected?

A. Well, there were some difficulties in the way. It was necessary to have the permission of the superintendent.

Q. They didn't seem to wish to have you go down? They threw obstacles in the way?

A. They didn't seem to—they didn't object; no objection was made; but we couldn't make arrangements for the purpose of going down, some way.

Q. You couldn't visit a mine, except by permission of the superintendent?

A. No.

Q. Did you visit any mine where the superintendent or foreman of the mine was not constantly with you?

A. Yes, sir, I did one; but not what is considered on the Comstock.

Q. On the Comstock lode you visited the mines only under the guidance of these superintendents, and they only took you to such places as they wished to show you?

A. Yes.

Q. Did you have any way of getting into any portion of the mine where you desired to go? Could you have done it on your own part?

A. Well, we might have done it, but in the intricacies of the mines probably we should have been lost, and very likely not found our way out very soon.

Q. They only took you to such portions of the mines as they wished to show you, you being their guests, as you may say?

A. They never refused when a wish was expressed to go to any part of the mines.

Q. Are the workings of these mines very intricate?

A. Yes, they are very extensive.

Q. Are there many miles of drifts in these mines?

A. Yes, a good many. I don't know how many, of course.

Q. Would it be possible for a stranger to go and find out where these bodies of low-grade ores are without a guide?

A. Well, he might stumble upon them, or he might not. It would be a difficult matter, at all events. I saw a good deal of low-grade ores, and took off specimens as I went. I carried with me my satchel and hammer, and where I thought there were low-grade ores, I took them off and examined them, and compared them with others.

Q. Provided the foreman or superintendent of a mine would want to mislead you about the condition of the mine, could he take you down into that mine and show you only such parts of it as would mislead you?

A. If he wished to do it, of course he could.

Q. Would it be possible for you to tell whether he did or not, taking into consideration the intricacies of the workings of those mines?

A. It would be impossible for a man unacquainted with the mines to traverse them, and make a thorough examination, without the aid of the superintendents or some persons who are acquainted.

Q. You entered these mines entirely under the guidance of these superintendents or their foremen, and only visited such parts as they took you to?

A. That is all. I don't think they would have objected, however, to our going to any part, if we had expressed the wish. By the time they had taken us around all they wanted to, we were glad enough to go out.

Q. Would it be possible, Professor, under the circumstances, going to such levels as they took you to, for you

to form a correct idea as to the quantity of water in the mines?

A. Yes, in the Yellow Jacket I think we could form a pretty good estimate?

Q. There was very little water in the Yellow Jacket mine, I believe?

A. There was a strong current of water, running pretty rapidly.

Q. In the Yellow Jacket?

A. In the Yellow Jacket.

Q. The superintendent states there was not one inch of water there?

A. Well, there was a strong current of water running.

Q. Which way was it running?

A. Nearly east, I think; no, rather northeast.

Q. The Yellow Jacket and Crown Point connect?

A. That's the same I refer to. The water runs from the Crown Point into the Yellow Jacket.

Q. Are you not mistaken? Isn't the Crown Point mine the deeper of the two?

A. It has drifted the deepest, but at the level we were on the other is higher. The water came—a portion of it—from Crown Point. That's what they told us.

Q. I think you have got the locality reversed?

A. I don't think I have.

Q. The Yellow Jacket mine is the higher mine, and the water runs from that into the Crown Point mine. They were not pumping any at the Yellow Jacket?

A. Well, I noticed a strong current of water running. It was covered. I don't know where it was running to. I don't recollect about that particularly; but I recollect distinctly about the water in that mine, and the water was quite warm. I thought it the wettest mine that I had visited.

Q. Which one?

A. The Yellow Jacket.

Q. Are you not mistaken about the locality?

A. No, I am positive with regard to the mine. I am

not quite so positive with regard to the course the water was running.

Q. The Crown Point makes no statement here. They were pumping a large quantity of water. The Yellow Jacket was not pumping. The water was running into the Crown Point?

A. It may have been running into the Crown Point, but there was quite a strong current of water running from that mine.

Q. How much water was there?

A. Oh, I couldn't tell you; it was covered up; but we could hear it going along, and in places we could slip our fingers in.

Q. Was there an inch of water?

A. No, I think not.

Q. Was it running rapidly?

A. One inch of water might spread over a large surface, say 18 inches. It was running rapidly.

Q. Well, say a miner's inch?

A. Well, it was more than that. There was more water in that mine than in any other mine that we visited, with one exception, and that was on another lode, not on the Comstock; at least I noticed more water there. Portions of the mine were quite dry.

Q. What advantages would there be at the mouth of the tunnel as an abode for people compared with Virginia City? Would you consider the climate better down there?

A. Yes, I should judge the climate would be better, because you are not so elevated there. Virginia City is pretty well elevated.

Q. How much lower are you?

A. I suppose 2,000 feet.

Q. What chances are there there for people to have little gardens and more comforts?

A. Oh, they could raise vegetables there, if they could get water to irrigate the soil.

Q. Have you seen anything growing down to the mouth of the tunnel?

A. Yes, I have had the privilege of eating vegetables there that were very good.

Q. All that is required is a little water?

A. I don't know how little. It would require some quantity, enough to moisten the earth.

Q. With water you can raise any kind of vegetables down there?

A. Not any kind; a variety suited to the climate and latitude. I know a great many vegetable you could raise there.

Q. Well, they can raise the more hardy vegetables there, at least?

A. I don't believe they can grow tallow there, for one thing.

Q. By having a little patch of ground down there at the mouth of the tunnel, could the miners raise some vegetables, and keep a cow, and get more of the comforts of life than they do up to Virginia City?

A. They would have greater facilities for doing so. Whether they would improve them or not, I cannot tell.

Q. Well, a good many of these miners have families, have they not?

A. That I don't know. It is to be presumed they have.

Q. Well, have you seen anything about Virginia City that is adapted to any sort of gardening or agriculture?

A. Yes, there was one place where they can get a little water, and where they have got a very nice little place—General Van Bokelens. He has got some trees.

Q. I mean generally speaking?

A. Generally speaking, no.

Q. Is there much besides rocks?

A. Plenty of rocks and wind.

Q. Could timber and firewood be supplied at the mouth of the tunnel any cheaper than at Virginia City by floating down the Carson river?

A. I should think they could, unless they are delivered by railroad for nothing.

Q. Are they very apt to deliver anything for nothing up there?

A. Well, yes; they extended to us the courtesy of the railroad.

Q. Do you know of any difficulty in running timbers and wood down the Carson river?

A. If there were sufficient water I don't know of any difficulty.

Q. Do you know of any law in Nevada to compel every man that has a dam on the river to leave a chute open to allow timbers and wood to pass through?

A. You must ask somebody besides me.

Mr. SUNDERLAND. You better consult the statutes.

Mr. SUTRO. The statutes will show it.

Mr. SESSIONS. Are these chutes in all the dams?

Mr. SUNDERLAND. No, sir; there are no chutes in any of the dams.

Mr. SUTRO. Well, there is a law allowing the running of lumber, timber, and wood over the dams.

Mr. SESSIONS. How high are the dams?

Mr. SUNDERLAND. The highest ones are 24 feet. We were permitted last year to run wood down by paying all the damages to dams. It is the only time it has ever been run down since any of the dams were built.

Mr. SUTRO. Do you see any difficulty, Professor, in floating firewood down the Carson river?

Mr. NEWCOMB. I know no reason against it.

Q. Did you hear of parties floating down thousands of cords last year?

A. That a very large body had been floated down.

Mr. SUNDERLAND. Below Empire City?

A. In that neighborhood.

Mr. SUTRO. To the mouth of the tunnel?

A. About the mouth of the tunnel.

Q. Didn't Mr. Bryant, of Empire City, float down thousands of cords last year?

A. Well, I saw Empire City wood, but whether it was floated down the Carson or not I couldn't say.

Q. They get their wood in the Sierra Nevada mountains and bring it down. Is there anything to prevent them floating it down the Carson river, provided they prepare their wood and have it all ready to float down?

A. I know of no obstructions, unless there is something in the river to prevent it.

Q. The parties over there proposed last fall to furnish us some millions——

Mr. SUNDERLAND. Well, if the chairman please, I object to any statements from Mr. Sutro.

Mr. SESSIONS. It is pretty remote.

Mr. SUTRO. Well, I will read a telegram dated——

Mr. SUNDERLAND. I object to it.

Mr. SESSIONS. What is proposed to be shown?

Mr. SUTRO. I want to prove this: The gentleman who has floated all the lumber and timber down Carson river for several years proposed to contract with me last fall to float down a large quantity of mining timber and firewood to the mouth of the tunnel; but we did not know exactly what we wanted, and we didn't make the contract. He told me at that time that it was necessary to contract early for it in order to get it. I telegraphed to him yesterday in order to find out at what price they could deliver it; but he telegraphs to-day:

"I can't furnish timber, for want of time. Wood \$8. I will deliver 5,000 cords of wood at \$8.

(Signed)

S. BRYANT.

"Empire City, Nevada, February 23d."

He means to say he will float firewood down at \$8 per cord, but he cannot furnish the timber for want of time. He hasn't prepared that timber.

Mr. SESSIONS. Is the firewood cut?

Mr. SUTRO. Of course.

Mr. SESSIONS. Can they throw it into the river and float it down?

Mr. SUTRO. Yes, sir; but they have to have men to guide it down. He states the price at \$8, but I have no doubt a large contract can be made for \$6 per cord, while the wood at Virginia City costs \$12 per cord. Timber can be deliv-

ered for \$18 per thousand, which costs at Virginia City, as far as I know, the lowest, \$24 a thousand. Mr. Day, however, stated to General Foster that it could be delivered at \$22.

Mr. SUNDERLAND. I know they charge us at Virginia City \$8 and \$9 a cord for the same wood this man telegraphs about.

Mr. SUTRO. This man telegraphs, "wood \$8." That man came down to the tunnel half a dozen times to make a contract, but we were not ready to make it then. Now it is too late to get it, but next year we mean to go there for 20,000 cords of wood and three or four million feet of lumber.

Mr. SESSIONS. Then, if you can put boards or timber in the river, it will float down stream?

Mr. NEWCOMB. I am quite positive it won't float up.

Mr. SESSIONS. When the water is high enough you can float wood down.

Mr. SUNDERLAND. Since that wood was floated down, the largest dams on the river have been erected—the Eureka and the Brunswick.

Mr. SUTRO. I have been told by Mr. Bryant, the man who has been very largely engaged in this business, that there is a law on the statute-book, which allows people to float their lumber and timber over these dams.

Mr. SUNDERLAND. All this timber and lumber, floated from Empire City, by permission of the owners of the Mexican mills, have been floated through their ditch, three miles long.

Mr. SUTRO. Well, how do you account for that 5,000 cords of wood on the river, of which we bought some right beside the tunnel?

Mr. SUNDERLAND. I just told you.

Mr. SUTRO. I don't know, Professor, that I have any further questions to ask you. I suppose, Mr. Sunderland, you are not ready to ask any questions to-night. I would like to ask a few more at our next meeting, or after you get through.

Mr. SUNDERLAND. Well, I would like to ask one question now, and go on at the next meeting.

Mr. SUTRO. All right, then; you go on.

Mr. SUNDERLAND. Professor, who is in possession of the Comstock lode?

Mr. NEWCOMB. It is held for the benefit of the stockholders, by the mining corporations, I suppose; and their officers have the control.

Q. You know the fact, I suppose, that the whole Comstock lode is now the property of the different corporations that are working it from one end to the other?

A. Well, as far as the Comstock is known, it is.

Q. With a few exceptions. I mean what is being worked now?

A. We don't know the extent of the Comstock.

Q. I don't know as we do.

A. I think we find it going a mile and a half farther from what we thought.

Q. I think we know it pretty well, but you and I may differ about it. Well, now, has Mr. Sutro or the Sutro Tunnel Company any interest in the Comstock?

A. Not that I am aware of.

Q. Has the General Government any interest in it?

A. Yes, sir.

Q. In the ownership of the mines?

A. Yes.

Q. What interest—the titles?

A. Yes, the absolute ownership.

Q. What mine?

A. There is one of the mines that has no title. We asked the party why he didn't get it; and that is the Crown Point. They hadn't got a title at the time we were there.

Q. Has the General Government undertaken to exercise any supervision of any acts of ownership over the Comstock since it was first discovered?

A. I don't know that it has.

Q. The parties in possession have been permitted to work it from the first to the present time?

A. Yes, provided they pay a certain sum of money per acre for the patents, and in this case they declined to do that.

Q. Now, don't you think it a little strange that an outsider, who has no interest in any mine on the Comstock, should come to us there, and tell us that we don't know enough to work our mines properly; that he knows a great deal more about it than we do; and then ask the Government to supply him with money to run a tunnel, so that he may work our mines in a better manner than we do now?

A. Well, I suppose men act from motives generally. These motives may be good or bad motives.

Q. I am not talking about the motives. In a free country, where a man has the ownership of property, ain't he generally permitted to use it as he pleases, without anybody interfering?

A. Yes, if he doesn't interfere with other people's rights.

Q. Well, is there any interference with rights in this case?

A. I am not aware that there is.

Mr. SUTRO. Will you allow me to ask the Doctor another question, just now, Mr. Sunderland?

Mr. SUNDERLAND. Well, just hold on a moment. You stated (to Mr. Newcomb) that a specimen of ore was brought from the Belcher to Mr. Sharon while you were in his company. Was there any reason why a specimen of ore should not be taken to Mr. Sharon, as well as anybody else, when ore was found in the mine?

A. I know of no reason why. I only stated the fact.

Q. Well, do you know whether ore was taken to other people besides Mr. Sharon?

A. I do not.

Q. You know that Mr. Sharon bought stock as soon as he got here?

A. Yes, sir.

Q. Nothing strange about that, was there?

A. I think it was perfectly natural for him to do it.

Q. Don't you know that other people were buying stock the same way? Didn't the stock go up the next day?

A. He told me the next day that he had lost \$2,000 on his purchase. He could have bought it cheaper the first day.

Q. Well, then, others had been buying before Mr. Sharon?

A. I don't know.

Q. Did you ascertain, or did you hear said, that outsiders always got information of a strike in a mine sooner than the officers of the company? Did you ever hear that while you were there?

A. I don't know about the outsiders.

Q. Men not interested in the mines, I mean?

A. I have heard it stated that parties that were perhaps interested to a limited extent may have had others employed to give them information in case of a strike.

Q. When I say outsiders, I mean men that don't hold a share of stock, have nothing to do with the control of a mine, and have no permanent interest there. Don't you know that such men employ miners, at the Comstock, to give them information of strikes before the officers know it?

A. Well, I know the stock board of San Francisco keeps agents for the purpose of giving the earliest information.

Q. Well, don't you know that the miner finds out the ore first?

A. He must.

Q. Ain't it an easy matter for him to feign sickness, get upon the surface, and give information about it to a man that has paid him \$5 or \$10?

A. Well, I suppose it is possible.

Q. Now, then, will the construction of this tunnel stop that?

A. If the mines are thoroughly opened, yes.

Q. How so? I would like to have that explained.

Mr. SHOBER. Let me hear that again.

Mr. NEWCOMB. If the mine is thoroughly opened, it will expose it, and whatever of real value there is there will be so determined that a transfer of shares will be a fair transaction between the purchaser and the seller. Both will have an opportunity of investigating and learning what it is.

Mr. SUNDERLAND. Do you mean to say, Doctor, that the mines will be any more thoroughly opened with that tunnel than now?

A. You can open it from the tunnel level in a hundred different places.

Q. Don't you know, Doctor, that one year before that tunnel can be in every mine that is now being worked on the Comstock, except the Sierra Nevada and the Chollar Potosi, which are working upon the surface and nowhere else, and the Overman, will be far below the level of the tunnel?

A. No, I don't know it. They claim that the Crown Point will be down to the tunnel.

Q. How deep is the Crown Point?

A. The Crown Point was down on the 1,200-foot level, penetrating to the 1,300-foot, when we were there.

Q. How far below the Point A, of the Gould and Curry croppings, is the point of that shaft there—the initial point? The initial point is what we all measure from.

Mr. SUTRO. It is the point we originally established.

Mr. NEWCOMB. The Crown Point from the initial point will carry you down, I think, some 1,700 feet.

Mr. SUNDERLAND. You were on the 1200-foot level, you say?

A. I think it was the 1,200. They were drifting down upon the 1300-foot level when I was there.

Q. You state in your report that this tunnel will be 1,900 feet, in round numbers, below Point A on this map, (indicating.)

A. Yes, which leaves the shaft about 200 feet to go to get to the tunnel level.

Q. How long will it take?

A. They said they were not going to work any on the 1,300-foot level until after they had worked out their bonanza above. That was the information we got.

Q. Don't you know that they are away below the 1,300-foot level?

A. I haven't had any information about it since.

Q. Now, I will have to examine you again on that, Doctor. I have got a report of the Gould and Curry company, where they say they made a depth of 294 feet last year; and I think if you examine all these reports you will find that they lie. General Foster said that in nine months that shaft will be below the tunnel.

A. That is possible, if they go on. I can't say how rapidly they will work it.

Q. Didn't you hear a determination expressed there by the superintendent to keep sinking all the time?

A. No, I didn't, except with reference to this particular one. With this one they specified that they would be down to the level of the tunnel by the time it reached them, or before.

Q. That's the Crown Point?

A. Yes.

Mr. SUTRO. Will you allow me to ask one question here, Mr. Sunderland?

Mr. SUNDERLAND. Certainly.

Mr. SUTRO. Are you aware that in England the depths of mines are reckoned from the adit level down generally; that that above the adit level is not counted? Are you aware that all the measurements of the mines of England are given from the adit level down? That is called the depth. What is above that is not counted?

Mr. NEWCOMB. I have heard it so stated.

Mr. SUTRO. You commence a new series of operations there. They mention the depth of the mine from the adit level, because what is above that is not counted. If a mine

in England is stated to be 2,000 feet deep, it means it is 2,000 feet from the adit level down?

Mr. SUNDERLAND. Have you visited any of those mines in England?

Mr. NEWCOMB. None except the coal mines?

Q. How deep are these adits?

A. Some of them a few hundred feet. I didn't take a memorandum.

Q. Is there anything in the running of these tunnels that would change even the phraseology here of calling the depth of such a shaft so many feet from the top?

A. Oh, no; there is no necessity for it. It is their habit. The adit is the point from which they go down and count. We may begin at the top of Mount Davidson, if we please.

Q. What is the greatest depth that any mines are worked in England?

A. They are down about 3,000 feet.

Q. How far below any adit?

A. Well, they are working under the sea.

Q. Yes, I know that. They do that without any tunneling, excepting a few hundred feet under the ground?

A. Yes. But the mines that are worked under the sea I did not see.

Q. How long are any of these tunnels that you have been in or that you know anything about?

A. Oh, I don't know. I traveled round for three days in the different mines belonging to a party whom I had been invited to visit.

Q. Do they permit any association, or corporation, or company, in England, to own more than one mine?

A. I know of no law against it.

Q. Nor I either. One objection made here by Mr. Sutro is, that too many mines on the Comstock are owned by one association.

Mr. SUTRO. I didn't say owned, but managed. Various people own them; but these people manage the mines.

Mr. SUNDERLAND. Now, Professor, I will just ask you if you know what vote it takes to elect a board of trustees?

Mr. NEWCOMB. A majority of the stock, I suppose.

Q. Is it at all likely that people who manage the corporations and mines on the Comstock can get control of the stock in San Francisco or Virginia City, where there is a great deal of prejudice, as I understood from Mr. Sutro, against the Bank of California and its friends, unless they buy it?

A. There is a great deal of stock hypothecated I know. In order to get a majority of stock, they have sometimes carried it up to an enormous price in the market.

Q. They've got a right to do that, haven't they?

A. Certainly, I suppose so.

Q. Don't the parties controlling the mines on the Comstock generally own a majority of the stock? Can they control a mine there without absolutely owning a majority of the stock?

A. I have heard of instances to the contrary, whether correct or not I do not know; it is merely hearsay.

Q. I would rather you would state what you know, Doctor.

A. Well, I never have paid especial attention to that department; only it is common report that the Bank of California furnishes money out of its funds, holding the stock hypothecated for the payment of the debt, and vote the stock.

Q. Can anybody else do the same thing, Doctor?

A. I suppose so. I don't know of anything to prevent.

Q. There are plenty of banks and plenty of money there, ain't they?

A. Well, I never had cause to complain of the want of it while I was there, personally.

Q. Well, then, this board of trustees, controlling a corporation, is simply the result of somebody having a majority of the stock to vote at the annual election, is it not?

A. I suppose a majority of the stock rules.

Q. Is there anything wrong about a majority ruling?

A. No, sir; I do not object to that.

HEARING SATURDAY, FEBRUARY 24.

Mr. RICE. Mr. Chairman and gentlemen, as counsel for the Sutro Tunnel Company, I propose to submit some few questions. Professor Newcomb, inquiry was made of you last evening by Mr. Sunderland, in substance, whether the owners of the mines upon the Comstock lode should not control their own property, and were not more competent to manage their business than an outsider, and whether they should not be allowed to manage it without interference. Do you not know that the owners of the mines made contracts with Mr. Sutro for mining through the tunnel before they acquired title to the mines, and that they hold their property subject to such contracts?

Mr. NEWCOMB. Those superintendents whom we met acknowledged that such a contract had been made, and Mr. Sutro states so also. I know it only by hearsay.

Q. Were they not mere squatters upon the lode, holding title only by sufferance of the United States, at the time Mr. Sutro acquired his rights from the Government?

A. There is a mining law in connection with that.

Mr. SUNDERLAND. Mr. Chairman, these are all questions that are determined precisely by the contract. There are copies of that contract in the books here.

Mr. RICE. This is in the nature of a cross-examination. I am speaking of questions you propounded the other night.

Mr. SUNDERLAND. Go on. I withdraw the objection.

Mr. NEWCOMB. I will say that there are mining laws in California, as well as in Nevada, that give the discoverer a right; he can register his claim, as it is called, and that is acknowledged as common law upon the subject. He has a claim upon it as his property during the time; but he has no claim, that I am aware of, as against the United States.

Mr. RICE. I wish to ask you now something in regard to ventilation. On page 7 of the commissioners' report,

it appears that the most effective mode of ventilating mines in present use is by connecting contiguous mines by drifts. Are not many of the mines so distant from each other as to render this mode of connection and ventilation very expensive?

A. It is expensive running drifts from distant points.

Q. Would it be necessary to construct these connecting drifts in succession as the mines are increased in depth, and, if so, how far apart? Wouldn't they have to be much nearer together as they descend, say below 2,000 feet?

A. The connections that are made are down about a hundred feet. There are what are called the 100, 200, and 300-foot levels. As you pass down, the connections can then be made, and whatever be the levels, if they correspond, drifts can be run to connect them without very great difficulty. They would be required, in order to make perfect ventilation, on each level.

Q. So you have to make your drifts, as you get down to a point where there isn't sufficient ventilation, by running from one to another?

A. The upper drifts would not benefit the ventilation in levels below them.

Q. Then, would it not be necessary to have these drifts nearer together as you get down to a very great depth? Wouldn't the heat be increased?

A. The heat would increase, and the necessity for ventilation, of course, would increase; and, if no other appliances were made, it would require rather frequent connections in order to cool off the rock.

Q. And it would consequently increase the expense of that method of ventilation?

A. Yes, sir.

Q. Will you give an estimate of the expense of constructing these drifts per foot? How near together do you judge the mines should be thus connected to render this method of ventilation feasible?

A. The drifts, as they generally run them, are about the ordinary size of drifts used for the purpose of exploration.

It would be equivalent to making an exploring drift. I don't know exactly the size.

Q. About what did you find the cost per foot to be, from your information?

A. Well, we have it recorded, but I do not recollect the precise amount. It is contained in the reports of the superintendents.

Q. If the Sutro tunnel were completed as contemplated, and the mines along the Comstock connected therewith, either by sinking shafts in the processes of mining; or by boring holes, in which the air could pass freely from the tunnel to the shafts, do you or not judge that ventilation thereby would be much more perfect and economical than by any other processes now in use on the lode, without mechanical appliances? If so, please state the facts.

A. There is no question that it would produce ventilation, and what they got thus would be so much clear gain. It would have a tendency to cool off the rock and render it more feasible for working. It would be better for the men as well as better for the mines.

Q. What effect would the constant moving of cars through the tunnel have on ventilation?

A. It would agitate the air and force it forward in the direction in which the cars might be moving, producing considerable of a current if the motion be rapid, say at the rate of ten miles an hour. It would produce a considerable current of air forward in the shaft.

Q. Would or would not these advantages be very much more marked in mining below the 2,000-foot level?

A. Well, that is a question in my mind. The effects of the movement of the air would be felt in the shafts and drifts above rather than below. You have there a stagnant atmosphere, unless you make use of appliances to force air down. I don't see how it could benefit, except in the cooling processes. It would be a benefit in that respect, because it would tend to cool the rock.

Q. Suppose the tunnel were a new point of operations for mining below, and machinery were placed there to assist

in the ventilation below the tunnel level, say 1,000 or 1,500 feet, (chambers built inside the tunnel and machinery put there to throw in compressed air, for instance,) couldn't that be done cheaper than it could be from the surface, 2,000 feet above the tunnel?

A. Certainly; it could be done at very much less expense.

Q. And consequently wouldn't there be a marked benefit in having this new point of operations for ventilation below?

A. Yes; but I understood your question to imply that it was to be done by the motion of cars.

Q. That was merely auxiliary.

A. At the tunnel level, of course, the distance being much less, you would have a better chance to cool off than at the surface; the less the distance the more perfect the ventilation.

Q. On page 8 of the commissioner's report, under the head of "DRAINAGE," I find this statement:

"Taking, then, the observations of the commission in connection with the statements of the superintendents of the mining companies, we are of the opinion that the tunnel, for this purpose alone, is not a necessity for the drainage of the Comstock lode. That it will effectively drain all those with which it shall be connected is obvious; but the same result can be attained by present means at less cost—a cost which, moreover, promises to become still smaller as the mines progress in depth."

And on page 9, under the head of "ECONOMY OF WORKING," I find the following:

"The item of drainage is not included in the above, as the tunnel will thoroughly drain all the mines connected with it without cost."

Now, I assume, from reading this, that in the first paragraph you say that the cost will be less by the present method than by the tunnel after the connection is made. How can you harmonize these? How is it possible, if, as last stated, the mines connected with the tunnel will be drained *without cost*, to drain them at *less cost* by the present method, and how can such less cost become smaller as the mines progress in depth?

A. The whole argument rests upon this proposition, simply, on the subject of drainage: to construct the tun-

nel for the purpose of drainage alone, would be incurring the entire expense we have given for constructing the tunnel. The interest upon that investment would be greater than the present cost of clearing the mines from water, so that it would be really more expensive through the tunnel, if we take the cost and interest into consideration, than to expend \$150,000 a year that they admit it costs now to drain.

Q. Then the explanation is, and the idea of the commissioners in this first statement was, that it would cost more to make this tunnel exclusively for draining purposes than it would to drain the lode by pumping?

A. Exactly. We decided against it as an absolute necessity for draining.

Q. Precisely. That is a satisfactory explanation.

Mr. SUTRO. Upon what basis did you arrive at that figure, Professor, that the cost is \$150,000 a year for pumping?

A. From the statements of the superintendents. They said the cost would not exceed \$150,000. The estimate that was made by taking the number of mines we visited, and assuming the figures of those that we did not visit, but which were working, gave an amount less than what was given by the superintendents.

Mr. SUNDERLAND. It seems to me the counsel is entirely competent to examine the witness, without having any body else to interfere. I should prefer to have Mr. Sutro wait until the counsel gets through.

Mr. SUTRO. I suppose that is a matter of choice with the counsel.

Mr. RICE. Perhaps it would be more connected to do so. My idea in taking up the examination was to dispose of each appropriate head at once, so as not to have repetition.

Mr. SUNDERLAND. This was gone over last night.

Mr. RICE. Professor, please state fully to the committee your opinion and judgment as to the value of the tunnel for the drainage of mines. What would be the percentage of saving over the present methods after the completion of the tunnel?

Mr. NEWCOMB. The tunnel will serve to drain the mines without expense, which now, according to one of the superintendents, amounts to \$150,000 a year; in other words, it would make a difference of \$150,000.

Q. Professor, are you familiar with the cost of transportation of heavy low-class merchandise upon the railways of the country?

A. Not especially so. I have heard it stated by an expert, a man very extensively engaged in the business in New England that it could be moved for two cents a ton a mile and pay a profit.

Q. Have you information from any other roads—say the Pennsylvania Central?

A. I have not. I haven't investigated that particular part of this case. The cost varies with the grade of the road.

Mr. SUNDERLAND. Two cents a mile, you say.

Mr. NEWCOMB. Two cents a ton per mile.

Mr. RICE. Now, what is your judgment upon the comparative cost of mining from the tunnel upward, and mining as at present carried on?

Mr. NEWCOMB. The difference would be, that it is easier to throw a body of ore down than it is to hoist it up; it is necessarily more economical, but to what degree is difficult to determine.

Q. After the tunnel is completed and a new base established, could not mining be carried on both above and below by machinery acting upon the principle of compensation—that is, by cages going down from above the tunnel level and coming up from below it by the one operation—very extensively?

A. It could be carried on both upward and downward, and if paying ore happens to be above as well as below, it could be carried on very advantageously. But if you had to hoist in one case, and lower a poor quality of ore in the other, that was to be moved out and not worked, the profit would be diminished.

Q. In mining down they have to remove the low grade ores with the paying ore?

A. In some cases they do it, and in other cases they use the ore for filling in stopes.

Q. Isn't the proportion of low-grade ores that they do not reduce much greater than the paying ores that they do reduce?

A. We were informed so by the superintendents generally; one stated that they were in the habit, in order to use up the ore and equalize things, of mixing poor rock that would not pay with paying rock. Whether that is a rule with them all or not, I don't know.

Q. Should you judge that there would be any special difficulty in operating through this tunnel by connecting the cars by clamps and by letting them run, one after another, upon a chain?

A. I don't know what difficulty there could be.

Q. Isn't it to your mind, Professor, a self-evident fact, that the operations of mining on the Comstock lode can be carried on very much cheaper through a tunnel, saving the cost of drainage and providing ventilation, than by the present methods?

A. We have an illustration in the case of a tunnel that is there now, where they employ but few hands, work rather poor rock, and have their own mill. They work through a tunnel, and the cheapness with which they do it enables them to work up rock worth \$16 or \$18 a ton, which cannot be done by hoisting works.

Q. You state in your report that the estimated yield of the mines in the Comstock lode, as operated at the present time, is \$15,000,000 per annum. Can you state approximately the number of tons of ore reduced to give this result, or, in other words, how much do they raise per day and reduce per day of paying ore?

A. The amount as given to us was figured up at 365,600 tons a year.

Q. About 1,000 tons a day?

A. A trifle over 1,000 tons a day.

Q. In your testimony last evening, I think you stated your opinion to be, that if mills and machinery, such as are

now in use for the reduction of the ores of the Comstock, were erected at the mouth of the tunnel, with such other machinery as might be used by reason of the abundance of water there for washing and power, the ores could be reduced and concentrated at one-half the cost of doing the same work by the present methods, which I think you estimated at \$10 50 per ton, or a saving of \$5 25 per ton. Upon this basis, what would be the gross amount of saving per annum in producing this \$15,000,000 with the tunnel completed and the ores reduced at its mouth? At \$5 25 saving a ton, and 1,000 tons a day, the saving per day would be what?

A. It would be \$5,250; as they work Sundays as well as other days.

Q. Well, now, assuming that all the expenses would be equal, excepting the royalty of \$2 per ton to the tunnel company, and deducting that charge, what would be the net saving to the owners of the mines per annum? I would like to have you figure that, and get it accurately. Two dollars from \$5 25 would leave \$3 25.

A. It would be \$1,186,250 per annum.

Q. I think you also gave the opinion that it would be practicable, with the water power, etc., available at the mouth of the tunnel, and with the introduction of the most improved machinery and processes for reduction and concentration, that ores which would assay \$10 per ton might be profitably worked, while by the present methods ores cannot be so worked when assaying less than \$30 a ton?

A. That is not correct.

Q. Well, state your case?

A. Starting with \$3 a ton for mining, the royalty would carry it up to \$5; the expense of transportation through the tunnel, (they are allowed by the contract 25 cents per mile a ton, but it has been placed at a lower figure by the consent of Mr. Sutro,) at ten cents a ton, would give \$5 10. Then the percentage of loss is to be deducted from that. At the present mode of reduction, it amounts to 25 per cent. of the gold, and even more than that of the silver,

from 30 to 35; 35 is the amount given by the miners, although they may save up to 30 in some cases: so that we have \$3 60 for loss, and that gives \$8 70, counting the expense of reduction nothing. Well, if we calculate the reduction expense at \$5 25, we can work rock worth \$13 95, and make it an even thing, without any profit.

Q. Then, what would you say is the lowest grade of ores that it would be profitable to work?

A. Well, it would take rock that would assay \$15 to make a profit upon.

Q. You think that with those improved works you could work ores down to \$15?

A. Yes, sir, upon the present standard of working and of loss. If you can work it down so as to make a saving of 20 or 25 per cent. of the amount, you change the conditions entirely, and the result must be different.

Q. Well, what would be that result?

A. If we estimate on working as closely as they do in Europe, with a loss of only 10 per cent., it would make \$9 70, instead of \$13 95: so that ores worth a trifle over \$10 a ton might be made to pay.

Q. Now, what, in your opinion, is the amount of ores taken from the Comstock lode which will yield from \$15 to \$30 per ton, and what is the proportion of such low-grade ores to the whole amount taken out?

A. As to the latter part of your question it is impossible to determine. We made very especial and persistent inquiries as to the low-grade ores, ranging from \$15 to \$30.

Mr. SUNDERLAND. From \$15 to \$30—what, Professor?

Mr. NEWCOMB. From \$15 to \$30 assay, not working. I have the evidence of numerous parties upon the subject.

Mr. RICE. Please read all those which bear upon the question?

A. In the Lady Bryan there is a mass of hundreds of thousands, if not millions of tons, that will, according to the representations of the superintendent, take the whole body together laying upon the surface, average \$8 to the

ton by the assay. In places, he stated, large quantities would yield \$15; how much he didn't say. Mr. Requa states that very large bodies of \$16 ore exist in the Chollar Potosi. Mr. D. O. Atkinson, postmaster at Virginia City, informed me that he had the control of the Empire and Imperial mine, or the one adjoining the Bullion. He struck a body of ore yielding \$19 per ton, which at the time did not pay for working. This was prospected in the middle of the quartz lode and ore 100 feet wide for some distance and a depth of 6 feet. Mr. George Atwood has been working as foreman, or in some capacity, in the mines for eight years, in the south mine of the Ophir, and he says there is a body of ore 300 feet by 300 and 100 in depth, of a grade averaging \$20 by assay. That has been used for filling in stopes; the average assay would be \$20. Besides this, there is an immense quantity in the North mine a little poorer by assay. That is not yet mined. He further stated that in the Crown Point there is a vast amount of ore that will pay \$20 a ton on the 200-foot level; that he will engage to take out 50 tons per day for one, two, or five years and pay \$2 50 per ton for the ore in place. Has been in connection with that mine for three years, and knows all about the upper levels, of which the present superintendent, he stated, probably knew nothing. He is at present the superintendent of the Eberhart mine, or was at that time. In our examinations and in conversations with the superintendent of the Gould and Curry and the Ophir, it was represented to us that large bodies of low-grade ores, ranging from \$15 to \$25, existed there.

Q. Professor, from all this can you form any judgment satisfactory to yourself of the proportion of ores which would assay from \$15 to \$30, as compared with the whole amount of ores taken out, or as compared with the amount of ores that they do work, assaying above that?

A. Oh, it would be merely guess-work. There is no such thing as calculating it.

Q. Well, the best judgment that you can give?

A. The quantity of low-grade ores undoubtedly is im-

mense, ranging from \$10 up to \$30. It would require a great many years to work it out.

Q. Well, then, to reach it in another way, if you had these appliances that we have spoken of and this tunnel completed, by which all the low-grade ores assaying from \$15 to \$30 per ton could be profitably worked, what would be the increased value of the Comstock lode?

A. That is a question that no mortal man can answer with anything like an approximation to the truth.

Q. Well, you could say whether it would be twice or three times?

A. It may be a thousand million of dollars; it may be more; it may be less. It may be about a hundred millions. I can't say anything about it definitely. It's a vast quantity.

Q. Well, it would be a vast increase?

A. It would be a vast increase. There is no determining it, because you are going down indefinitely with it, and we don't know what the quality of ore is below. We may meet with a whole mass of only \$20-rock below the 2,000-foot level.

Q. Well, judging from what has been worked, and from your own information, of course?

A. It's mere speculation.

Q. If it should continue in the same way, the increased value would be enormous, would it not?

A. Yes; it would be enormous. There is no question about it in the minds of the commission. I have no reason to doubt it, and, with one exception, all the superintendents expressed themselves so. I will state that evidence was given by one of the miners still further upon that subject. He said that the amount was perfectly enormous; it couldn't be calculated to his certain knowledge. That was the president or other officer of the Miners' League; I do not recollect his name. He stated that the amount of low-grade ores was very great. He said he was then at work.

Q. Speaking of these leagues, Professor, what are they composed of? What interests do they represent?

He computed merely the cost of mining

A. Well, I suppose the labor department especially—the miners' interests.

Q. The operative miners rather than the owners?

A. Yes; the operative miners are the ones that formed the league, undoubtedly.

Q. Did you get the name of this president?

A. I have it. I can give it, if it is desired.

Mr. SUTRO. Doctor, didn't that party give you an injunction not to use his name; do you recollect? Did he not say it might jeopardize his interests?

A. No, sir.

Mr. SUNDERLAND. I don't want to have anything go in evidence from a man that is afraid to give his name.

Mr. SUTRO. Let the Doctor give his name, if he has it.

Mr. NEWCOMB. I have the name. It is James Dockery. He is a practical miner.

Mr. RICE. Did you see any officer of the other miners' association?

Mr. NEWCOMB. I don't know. We met members. We took no particular pains to ascertain their names, but endeavored to get at the general facts.

Q. Was this Mr. Dockery speaking for the association of which he was president?

A. He was speaking, I suppose, as an individual. I happened to ask the question, if it were true that there were large amounts of low-grade ores in the mines, and he said the quantity was enormous: "incalculable," I think, was his expression. They couldn't determine how much.

Mr. SUNDERLAND. He is a practical miner.

Mr. SUTRO. Are you quite sure it was Mr. Dockery that gave you that statement of the low-grade ores?

Mr. NEWCOMB. Yes, sir. It is so marked in my notebook. It was taken down at the time.

Mr. RICE. In your estimates, Professor, bearing upon the economy of working these mines, what disposal did you make of the raising of the low-grade ores and the waste rock?

Mr. NEWCOMB. We computed merely the cost of raising

the paying ore. As mentioned particularly in the report of the commission, no approximation could be made of the cost of raising the debris. We had no means of determining the amount, but it was very great.

Q. Well, was that included in the estimate of raising the paying ore?

A. I think not, sir. It was merely the cost of raising paying ore.

Q. Wouldn't that increase the expenses very much of the operations it was estimated for?

A. It would cost just as much to raise a ton of the country rock as it would a ton of the paying ore.

Q. You obtained no estimates from these superintendents of the amounts of low-grade ores and rocks raised?

A. They gave no account of them in their report to us.

Q. Well, then, Doctor, is it making a fair comparison of the expensiveness of operating by the present methods and by the tunnel to omit these important items?

A. We mentioned that in the report, making it a point that the amount is very large, and that it would be fair to include it in the amount, but we had not the means of determining it.

Q. If you should arrive at the facts in regard to it, would it not, in your judgment, materially change the figures as to the comparative methods of working?

A. Yes, sir; necessarily.

Q. Wouldn't it, instead of throwing the balance against the one, change it very much on to the other side?

A. Without going into a calculation, I should think it would.

Q. By the bill now before this committee, it is proposed that the United States shall grant as aid, for the construction of the Sutro tunnel and its branches, certain sums of money, not to exceed in the aggregate \$3,000,000, the Government retaining a first mortgage or lien thereupon, together with all engines and machinery and appurtenances thereunto belonging, for the repayment of said moneys, and also twenty-five per centum of the net amount which shall

be collected by the tunnel company as tolls for the transportation of ore, rock, and material, or in any other manner. From your investigation and knowledge upon the subject, do you deem it advantageous to the United States to grant such aid, and, according to your best judgment, do you believe that such security upon the property, franchises, and earnings of the company would be ample for the payment of such aid or loan?

Mr. SUNDERLAND. I want to have the reporter note an objection to this.

Mr. NEWCOMB. I should deem it a safe investment, and if I had \$3,000,000 to dispose of, I would put it, under those circumstances, in the tunnel.

Mr. RICE. And regard the security as ample?

A. And regard the security as ample; taking such precautions in regard to it as would insure that the investment be properly and thoroughly made.

Q. Do you or do you not regard the construction of the Sutro tunnel important in its bearing upon geological and scientific research as an exploring work; and if it should successfully demonstrate the downward extension of fissure veins and the value of deep mining, what, in your judgment, would be its effect upon the mining interests of the United States and their future development?

A. Well, as an exploring work, I don't know that any superintendent differed in opinion from me that it might be of very great value. Some expressed their opinion that it would be valuable. My own opinion is very clear upon that subject, that it would be of very great importance in a scientific point of view, and it would lead to similar enterprises, under similar circumstances, with the same character of rock. It would demonstrate whether the ore-bearing character of fissure veins extends downward here as in other countries. It would lead to further works of a similar kind to develop the mining industry of the country to a vast extent. The question in my own mind was, whether it would be applicable to other conditions, where the silver or gold is in combination

with the base metals. I question very much, and yet I am not prepared to give a decided answer, that in the argentiferous galena the effect might be less favorable. I am not prepared to answer for that portion of it.

Q. Would you judge that, with all fissure veins having the like conditions of this, it would be of very great advantage, and would give encouragement for capitalists to invest their means, this being a demonstration of these great principles and facts?

A. I concur with everybody, I believe, upon that subject that it would be. I don't know of any difference of opinion upon it.

Mr. SUTRO. In the early days of mining on the Comstock lode, did they not run a great number of tunnels for the purposes of exploration and the extraction of ore?

A. To use a common expression among miners, the hills are pretty thoroughly "cayoted;" that is, holes are dug, that may be seen at the present time in almost every direction on the syenite and in all different formations. All the hill-sides are perforated in various directions by the labor by those who were searching for minerals.

Q. This map here, Doctor, shows 68 tunnels perforating the Comstock lode. Is the configuration of the country such that, after the mines had reached to a certain depth, no tunnels could have been made except by beginning off at a very great distance?

A. The configuration of the country is such that, to strike it at a low level, no more favorable point could have been selected than the one Mr. Sutro has chosen, in my opinion.

Q. If you will look at this map, you will find that in the early workings they ran their tunnels in from the slope of the mountain, and ran in just as many as they possibly could. The hills rising to the eastward then made it an impossibility to make deeper tunnels, except by going off a number of miles. Do you find that to be correct?

A. Yes, sir; that is correct, according to the best of my recollection.

Q. In order to arrive at another question, I want to read

from the report of Mr. Raymond, the United States Commissioner on Mining, a gentleman who has had a vast deal of experience in mining, and who graduated at the mining school of Freiberg. He says, in his report to Congress for 1868, on page 51, in speaking of the difficulties of mining:

"One great cause of trouble is the fact that mining has not on the whole been profitable to individual adventurers; and of this fact the Comstock lode has furnished a striking example. Nearly \$100,000,000 have been extracted from that lode within the past eight years, yet the aggregate cost to the owners has been almost as much. The reason is simple. Unnecessary labor has been employed, and vast sums of money have been wasted in extravagant speculations and litigations, and the root of the whole evil lies in the system of scattered, jealous, individual activity, which has destroyed, by dividing, the resources of the most magnificent ore deposit in the world. Thirty-five or forty companies, each owning from 1,000 to 1,400 feet along the vein, and each (almost without exception) working its own ground independently; 40 superintendents, 40 presidents, 40 secretaries, 40 boards of directors, all to be supplied with salaries, or, worse yet, with perquisites, or, worst of all, with opportunities to speculate; an army of lawyers and witnesses, peripatetic experts, competing assayers, thousands of miners uniting to keep up the rate of wages—these explain the heavy expense of Comstock mining. Aside from this immense drain of money, amounting to 20 per cent. of the whole production, the labor actually performed has been, for want of united action, often useless. There have been tunnels enough run by different companies into the Comstock lode to make, if put together, the whole length of the Sutro tunnel. Hardly one of them is good for anything to-day. The Bullion company, which has the deepest shaft on the lode, never had any ore, but has spent more than a million of dollars in prospecting, while some neighboring mines, like the little Kentuck, have been in *bonanza* for long periods. Now, this division of a vein, which gives the rich chimney to one owner and the barren intervals to another, is not conducive to economy. The result has proved to be that both owners waste money. All the explorations in the barren mines of the Comstock could have been executed with the money flung away by the mines that have had for a time rich ore."

What I want to ask you, Doctor, is, wouldn't the construction of the Sutro tunnel tend to consolidate these mines into united action, and abolish, to a large extent, this multiplicity of superintendents, presidents, secretaries, and boards of trustees, which are now kept up at an enormous expense?

A. The tendency would be in that direction, but it is very difficult to determine what the result would be. Great conflicting interests would be stirred up in making a joint-stock company out of the whole. There would be very great difficulties attending it.

Q. Wouldn't the management of the mines be put on a rational and united plan of operations by having one base of operation?

A. No doubt it would be of very great advantage. Whether they would see it in that light, I can't say.

Q. According to your opinion, wouldn't it be self-interest to these different mining companies to join under one system of mining, after the completion of the tunnel?

A. They might adopt a uniform system without uniting their interests. The poor-paying mine would be very glad to enter into a combination with rich-paying mines, but the reverse would not be likely to occur. Those who have a rich bonanza, and are working upon it, wouldn't wish for a partner with no capital.

Mr. SUNDERLAND. No; I don't know that the Kentuck there would join in with the Bullion.

Mr. SUTRO. Wouldn't the system of equalizing the different mines, so as to make the mine that is ore-yielding contribute to the tunnel, while the non-paying mine would enjoy the benefits of the tunnel for nothing, tend to stimulate exploration, and open up mines which are not now ore-yielding?

Mr. NEWCOMB. There is no doubt about that in my mind.

Q. Then the tunnel would really be putting a premium on explorations by facilitating them?

A. It would be an incentive for people to explore the mines.

Q. Wouldn't that, in your opinion, increase the yield of bullion on the Comstock to a very large extent, by promoting searches for new bodies of ore, which otherwise would probably never be developed?

A. "Never" is a long word.

Q. Or which would only be developed under great difficulties?

A. I accept that, and answer in the affirmative.

Q. Mr. Raymond goes on to state:

"At present, however, the tendency is more than ever the other way. As the prospects of mining on the old wasteful plan grow darker and darker, officers, agents, and stockholders bend their energies to save what they can by speculation out of the approaching wreck. We might well afford to leave them to their fate, but for the fact that the effect of the abandonment of the Comstock lode would be almost fatal to systematic and permanent mining in the Pacific States. It would confirm the mischievous feeling that mining is

half grab and half gamble; that the only way to make money at it is to dig out what rich ore you can get, and then find a fool to buy the property; or, failing that, to make a fool of that collective individual the public, and unload yourself of your stock."

Would you consider that about the thing?

A. The case is very well put there.

Q. You would confirm what Mr. Raymond states?

A. I would confirm that, most emphatically, excepting the remarks as to the running out of the material; I shouldn't agree with him upon that point.

Q. Then he states further:

"The Sutro tunnel will do four most important things: it will settle the continuance of the Comstock in depth; it will inevitably unite the mining companies in many respects, and remove much of the expense of separate pumping, hoisting, prospecting, and general administration; it will render possible the beneficiation of low-grade ores, absolutely the only basis for rational and permanent mining; and, finally, by assuring the future, it will kill that speculation which thrives on ignorance of the future."

A. I assent to that proposition.

Q. Would the tunnel open up the mines in such a manner as to lay bare the lode, so that they cannot speculate any longer on prospective strikes as they do now?

A. It would have that tendency to a very great degree, but it would not, perhaps, entirely do away with speculation. As soon as the lodes were thoroughly explored to a depth of 2,000 feet, they would acquire a knowledge of their value, people who deal in stocks would become informed; and, instead of putting in money simply as a matter of speculation, they would purchase as an investment, and, instead of continually changing, the proprietorship would remain the same.

Q. Do you know, Doctor, that in the mines of Germany they make their explorations so far ahead, that they often have ore enough in sight to keep up their explorations for a great many years?

A. That is the rule in most mines that are well conducted.

Q. Do they act on that plan on the Comstock lode? Do they do any work ahead, so as to secure the mines for the future?

A. I think they do to some extent, I think they have

carried on their explorations to a greater or less extent, at the same time that they have been working out their richer bodies of ore.

Q. Isn't the main object to search for rich bodies of ore; and, when they find them, to crowd in just as many men as can find place to stand, and work and gouge out the ore, so as to make large dividends and run up the stock?

A. That has been the practice to a great extent, to be sure, but still there are further researches continually making in these mines; I think in all the mines that are being worked at the present time. Even in the Crown Point, where there is a large bonanza, they are running drifts for the purpose of determining the value of the mine. They were sinking an incline for working down on the 1,300-foot level when I was there.

Q. Well, Mr. Raymond goes on to state as follows:

"I do not think the tunnel would prove a pecuniary loss in the worst event, since it would also explore in depth a country which is very likely to contain vast bodies of rich ore. All the indications are *that the origin of the Comstock bodies was east of the vein*, and promising deposits are already known to exist in that direction."

Does that coincide with your views, Doctor?

A. I couldn't pronounce positively in regard to the richness of the veins to be struck, but I think the evidence is quite conclusive that there will be large bodies of low-grade rock, if not of rich ore, found in the process of construction. There are two that are well known already—the Flowery lode and the Monte Christo—both of which give evidence of containing a good deal of mineral; and at the depth they will be struck by the tunnel they will be likely to yield considerably. It will probably very soon be determined with regard to one of them.

Q. Now, in regard to working the mines to a greater depth below the tunnel level, Mr. Raymond, in a footnote, states:

"The direct saving in drainage is doubled by the fact, that the water now lifted at great expense by steam would, if allowed to fall instead, itself generate a motive power to take the place of steam. Hydraulic engines, utilizing this source of power, are common in the deep mines of Europe, but have never been introduced in this country. In the case under discussion, the conditions would be extremely favorable, permitting a hydraulic column of 2,000 feet.

Fifty gallons of water per second, with a fall of 2,000 feet, create a working capacity of 1,800 horse-power. Another way of utilizing the water of drainage would be the erection of water wheels underground, by which various operations requiring machinery could be conducted. This, too, is very common in Europe, and, like the use of hydraulic engines, may be introduced with advantage wherever there is deep tunnel drainage. In the absence of deep drainage, both these economical devices of science are out of the question. If the Sutro tunnel is completed to the lode, and connected with deep shafts, *the conditions for further explorations to still greater depths will be more favorable than they were at the very surface, since the immense power of the hydraulic column will be at the service of the miner.*"

Can you see any difficulty, Doctor, in utilizing the water in those mines, which is stated to exist in large quantities above the 800-foot level, and carrying it down in pipes to the tunnel level for driving machinery?

A. There isn't any difficulty about it; and I should consider it feasible to accumulate the water upon these levels and transfer it in tubes, to create a power for operating the mines to a lower depth than 2,000 feet.

Q. This is a very important subject, this of carrying a water power into the mines. It is a subject that I have often urged, although I have not alluded to it before in this examination. That there could be no difficulty in collecting the water at any point down in the mines is best shown by a statement made by Mr. Batterman, the superintendent of the Gould and Curry company, in his annual report, made December 25, 1871. On page 8, he says:

"Four hundred and twenty-five feet of the shaft have been retimbered, which is now in good working order its entire depth. A tank large enough to accommodate the water of the mine for twelve hours has been built at the sixth station, materially reducing the cost of pumping."

If these tanks were stationed all along in the different mines, and pipes were carried down to the tunnel level and applied to hydraulic engines, (turbine wheel or other kinds, whatever be most economical,) would you not create a power that would enable you to go down below the tunnel level, say at least 1,000 feet, without any additional power?

A. If you have a supply of water sufficient, it would accomplish that end, no doubt.

Q. Take the statement of the superintendent of the Ophir mine, according to which we have an average for

the last year of 1,005 tons of water, for every 24 hours, hoisted or pumped out of that mine. Supposing that quantity of water were carried to the tunnel level in a pipe and applied to machinery, would it not create a power sufficient to work that mine down to a very great depth below the tunnel level?

A. It would give power for mechanical working at a very low depth.

Q. Well, could that power not be created at comparatively little cost? Is it not creating a power in the very mines themselves with the water which it is now so much trouble and expense to get out? Could it not be used for the purpose of getting down to greater depths below the tunnel level?

A. We all understand that, with the weight of a column of 600 or 800 or 1,000 feet of water, an enormous power is created, and a small amount of it applied to a wheel will produce an action that can be used in the reduction of ores or for the various purposes of mining.

Q. Professor Weissbach, the most eminent engineer of the century, whose works are used in every land in the world, and in every university, and by every engineer, makes the following statement in regard to this power:

"With a fall of 2,000 feet, a working power created by one gallon alone, (equal to one-sixth of a cubic foot, equal to ten pounds of water,) per second, is equal to 20,000 pounds for every foot; that is, 20,000 divided by 550, equal to 36 horse-power. A quantity of water, 50 gallons, introduced per second, would therefore create a working capacity of 1,800 horse-power."

A. Yes, it is perfectly enormous.

Q. In your opinion, Doctor, could not reservoirs be created on the surface, even several miles away from the Comstock lode, at desirable points, where the configuration is such that great dams could be erected and lakes formed, which would be filled during the winter by water and snow, and supply an additional power in these shafts than what could be obtained from the water in the mines themselves?

A. Oh, there is no doubt it could be accomplished. The expense is a matter that I am not prepared to answer. We

know that the accumulation of water mostly is made for the water-works in small tunnels that perforate the mountains in various directions, not to very great depths, giving supplies to Virginia City. As I understood when I was there, they have in contemplation the bringing of the water from a greater distance. Whether they have accomplished that or not I don't know. It shows that the water can be accumulated as you suppose.

Q. I refer to the water that may be obtained during the winter months. As the snow melts it gives a large quantity of water, and by erecting dams at suitable points in the ravines, within five or ten miles of Virginia City, do you not think that a supply could be obtained that would last the year round?

A. I think there is no doubt that within a limited distance you could get all the water required for your object.

Q. Are you aware, Professor, that in the Harz mountains, and in Freiberg, where mining is probably carried on more intelligently than anywhere else in the world, they have dozens of such lakes and reservoirs, which are applied in the very manner I mention?

A. Yes, sir.

Q. I want to ask you still another question in that connection, which almost escaped my mind. Is it possible in mining to apply any water-power of this kind within the mines, or utilize the water which falls on the surface and is caught in reservoirs, except by having a deep tunnel to lead it off?

A. If you let it in a mine not connected with a tunnel, you have to pump it up again, and that would cost more than the gain would be. You might as well use the power you have in the first place.

Q. Would it be possible practically?

A. It would not be practically possible.

Mr. SUNDERLAND. I don't understand either the last question or the answer. What was it?

Mr. SUTRO. My question was this: Is it possible in the mines to utilize a water power created by the water con-

tained in the mine, or by accumulated water outside of the mine, except by having a deep tunnel to carry it off after it is used? The operation of this water power is such, that you place your hydraulic machinery at the tunnel level, at the point where it connects with the shaft, and the water column comes down and drives the machinery and discharges itself, then running out of its own accord. The water which it pumps from below the adit is also discharged through the tunnel. Isn't that the way you understand the operation?

A. Yes, sir; that is the mode of operation.

Q. What is there to prevent this power being applied also to the purpose of hoisting ores from below the adit level?

A. Why, it would be useful for any mechanical appliance.

Q. Couldn't that water power also be used for condensing air and ventilating the mines below the tunnel level?

A. You might use condensers at that point. All you want to condense air is power; and you get power by the application of water.

Q. The great argument, Doctor, against the tunnel, for the last five or six years, has been that there is no ore below, and that it would be necessary first to discover ore in great depth before the tunnel would really be required.

Mr. SUNDERLAND. Well, that isn't the argument at all, Mr. Sutro.

Mr. SUTRO. Mr. Sunderland, I propose to read from Mr. King's report on page 166:

"Should these shafts, with their connecting prospecting works, placed as they are at intervals along the length of the lode, fail to develop any valuable bodies of ore in depth, the tunnel would not be likely to do so, and there would be no necessity for its existence. On the other hand, should these explorations prove the existence of great bodies of ore in depth, the tunnel would become a great desideratum, if not an absolute necessity."

Well, they have discovered those now. That objection is removed. I want to read again from Mr. Raymond's report for 1870, on page 93. After speaking of some dis-

coveries which have been made in the Comstock lode, he goes on to say :

"Since much doubt has been thrown upon the enterprise of Mr. Sutro, on account of the alleged barrenness of the Comstock in depth, it is fortunate that this development has occurred in time to encourage the prosecution of the much-needed deep tunnel. This tunnel is now in process of construction, and has been carried in about 1,900 feet, through various alternations of rock, and several veins, none of which, so far as I am aware, have been prospected. A good deal of water has been met with, which may be considered, so far as it goes, a favorable indication of the existence of fissure veins in the neighborhood, although at the inconsiderable depth thus far attained the significance of its occurrence is not important. My opinion as to the necessity and value of this tunnel remains unchanged, except so far as it has been strengthened by recent developments upon the Comstock. As a means of exploring that vein to a depth heretofore unattained in metal-mining, it would be indispensable. Some of the mines in the Comstock are now approaching the level of the tunnel survey; but the expense and difficulty of going deeper will be wellnigh insurmountable, without an adit as a new basis of operations. The effect of a tunnel, adequate for drainage, transportation, and ventilation, is to create a new artificial surface, with the added advantage of a hydraulic power, measured by the quantity of water and the height of its fall above the tunnel level. A few months ago, suggestions of this nature were met with the reply, that the Comstock shafts were not finding ore in depth, and that nobody was likely to desire to go much deeper in barren ground. In successive reports I have uniformly regarded this barren ground as a zone beyond which ore bodies would again be found; and this opinion is now so far confirmed, that I presume no one will discourage further explorations in depth, up to the limits of mechanical practicability."

Do you think, Doctor, that there are any doubts entertained, after the discoveries which were made in the Crown Point mine, in the Belcher mine, at the 1,200 and 1,300-foot level, and lately in the Savage mine, at the 1,400-foot level, that the Comstock lode extends downward indefinitely?

A. I had no doubt of it before the discoveries were made. They only confirm the opinion I have often expressed upon the subject.

Q. In your opinion, Doctor, would not the introduction of an intelligent, rational system of mining have an influence upon the whole mining interests of this country, of such a character as to give a stimulus to the business that we cannot now comprehend?

A. It would have a powerful effect upon our mining interests, and to the advantage of those interests. I conceive that the whole extent of country through that region is comparatively worthless, with the exception of the mining interests. The Almighty has given us minerals there

in compensation for lack of anything else, and has given an abundant supply.

Q. That being the case, Doctor, would not the populating and settling of that vast area create a market for the grain products of the Western States and the manufactures of the East?

A. Well, every industry that is encouraged fosters other industries, for one is dependent upon the other to a very great degree. There is no question that, if our mining interest were fostered by the Government, other interests would be aided as well. In mining extensive machinery is required; clothing is required; the necessities of life must be brought from elsewhere usually. Whatever benefits mining benefits the East and the West in other interests, and the mines are the very life-blood of Nevada.

Q. As a consequence, it would enhance the value very much of these Pacific railroads in which the Government is interested?

A. Well, I am not fully posted upon that. You must get experts on that. It carried me safely over; that was all I required. They have been stuck this winter pretty badly.

Q. I want to recur now, Professor, to a question which was put to you by Mr. Sunderland yesterday, whether the mine-owners ought not to be the best judges how to work their mines, and whether they don't understand their interests better than an outsider. In this connection I want to ask you whether you are aware that the construction of this tunnel was first authorized by the Legislature of Nevada; that contracts were entered into by nearly all these mining companies; and that the work was authorized by special act of Congress?

A. I am aware of all those things; and that the patents were received from the Land Office, subject to the condition of the payment of \$2 a ton for the working ore that might be raised or removed through the tunnel.

Q. That's the very point I want to get at. I have a copy of a patent here, which was specially gotten up by the

authorities in Washington for these mines on the Comstock lode. This patent, which gives the title to those mines, contains a clause which I wish you to read, Doctor—the fourth clause?

A.

"Fourth. That the claim hereby granted and conveyed shall be subject to the condition specified in the 3d section of the act of Congress approved July 25, 1866, granting to A. Sutro the right of way and other privileges to aid in the construction of a draining and exploring tunnel to the Comstock lode, in the State of Nevada; and the grantee herein shall contribute and pay to the owners of the tunnel, constructed pursuant to said act, for drainage or other benefits derived from said tunnel, or its advantage, the same rate of charges as have been, or may hereafter be, named in agreement between such owners and the companies representing a majority of the estimated value of said Comstock lode at the time of the passage of said act, as provided in said 3d section."

Q. Have they any title to their mines but what they get from the United States Government?

Mr. SUNDERLAND. I object to that.

Mr. NEWCOMB. They have none but a squatter's title. It is sometimes called a "squatter's title," sometimes called a "miner's title."

Mr. SUTRO. Since this question has been brought up by Mr. Sunderland, I think it is proper to throw some light upon it.

Mr. SUNDERLAND. We all know what the law is.

Mr. SUTRO. Mr. Sunderland has spoken of the tunnel company as an outside party.

Mr. SUNDERLAND. Yes, and I do.

Mr. SUTRO. Well, it seems from the patents, and by the documents in relation to it, that the tunnel company derives its rights directly from the Government, and that the titles to these mines were only granted upon condition that they comply with certain conditions imposed by law.

Mr. SUNDERLAND. The contracts have never been complied with by Mr. Sutro.

Mr. SUTRO. Well, if this question comes up here before the committee, I propose to show that, if the contracts have not been complied with, it has not been the fault of the tunnel company; but that it has been due to the machi-

nations of the Bank of California, which has tried to upset them.

Mr. SHOBER. Shall we go into that field of inquiry?

Mr. SUTRO. It would be a pretty lengthy one.

Mr. SESSIONS. I don't understand that Mr. Sutro proposes to.

Mr. SUTRO. I don't propose to go into it. I simply want to ask certain questions, in order to explain a question which was put by Mr. Sunderland, and it would probably be desirable and proper to quote from a debate in Congress, where this very question was discussed and settled finally, by a vote of 42 to 124.

Mr. NEWCOMB. Well, I wouldn't go into that. That will come up in your argument.

Mr. SUNDERLAND. I object to it.

Mr. SESSIONS. Ask your question, Mr. Sutro. We'll see what it will be.

Mr. SUTRO. I wanted to get at the point, whether these people over there had any title; whether they have anything to complain of; whether they were not simply squatters, who went on the land at sufferance of the Government?

Mr. SUNDERLAND. That is a question of law, Mr. Chairman.

Mr. SESSIONS. It appears already that they have no title, excepting that which they get from the General Government. This title, which has been read here, shows that they took their titles in subordination to the grants made to the Sutro Tunnel Company, as embodied in the act of Congress.

Mr. SUTRO. I will drop that part of it. It will lead too far to go into the subject. Doctor, I want to ask you a question which came up in the examination of General Foster, and that is in regard to this statement about the cost of hoisting ore in the commissioners' report. I want to get at a matter which I don't think is fairly understood. What proportion of the Comstock lode is engaged simply in prospecting, and consequently only hoisting refuse rock—

country rock? Can you form any idea of what that proportion is, as compared to that part which is productive? Commencing at the south end, we have first the Overman and Uncle Sam; were they doing anything but prospecting?

Mr. NEWCOMB. Nothing, when we are there.

Q. Did they take out any ore in depth?

A. Not that I am aware of.

Q. Then we have the Segregated Belcher; were they taking out any ore?

A. That I don't know.

Q. The Belcher company have since discovered ore, I believe?

A. About the time of our leaving they struck a large bonanza.

Q. Then there is the Crown Point?

A. The Crown Point is productive.

H. Then there is the Yellow Jacket?

A. The Yellow Jacket was yielding at low depths and very generally.

Q. Then came the Burke and Hamilton, Gold Hill; did they have anything?

A. I don't know.

Q. Then there is the Confidence; it belongs to the Gold Hill mines?

A. I am not posted upon whether these mines extending through here produce anything, or but very little.

Q. Then that would include the Challenge and Imperial; do you know anything about the Imperial?

A. I don't know anything about the Imperial.

Q. Do they produce any ore in depth?

A. Not that I know of.

Q. Then there come the Rice Ground, Consolidated, Winters and Kustel, Pi-Ute, Bowers' Plato, Empire South, French, Eclipse, Empire North, Bacon, Imperial, and Apple and Bates. They all belong to Gold Hill. Do any of them produce anything?

A. Nothing that I heard of.

Q. Then there is the Alpha; did that produce anything?

A. I don't know about it.

Q. Then there is the Exchequer.

A. I know nothing about it.

Q. There is the Bullion.

A. The Bullion has made pretty extensive excavations, without getting anything from the start.

Q. Then there is the Chollar Potosi?

A. That is yielding.

Q. Not in depth?

A. They are not working in depth. I don't know how much it might yield in depth. They were working upon the upper levels.

Q. Then comes the Hale and Norcross?

A. Working when we were there.

Q. And the Savage?

A. Working.

Q. Did the Savage have anything in depth at that time?

A. Not in depth.

Q. Did the Gould and Curry have anything in depth?

A. No, sir.

Q. Did the Best and Belcher have anything, or the White and Murphy, or the Central, or the California?

A. A number of these have been united into the Consolidated Virginia.

Q. Has the Central anything?

A. Nothing that I know of.

Q. Has the Ophir anything?

A. Nothing.

Q. The Mexican?

A. They were working, but at no great depth.

Q. I mean in depth; have they anything in depth?

A. Not that I know of.

Q. Then comes the Ophir north mine; have they anything?

A. Nothing.

Q. Has the Union anything?

A. Nothing.

Q. The Sierra Nevada?

A. They were working on the surface; nowhere else.

Q. Have they anything in depth?

A. Nothing that we could learn.

Q. The Allen?

A. Nothing.

Q. And the Utah?

A. That was the same.

Q. Then, according to this, a very large proportion, probably three-quarters of the lode, to say the least, is simply being prospected; they are not taking out any ore. Does that agree with your ideas?

A. There is a very large proportion of them that were either not working at all or were merely prospecting.

Q. Now, supposing this tunnel were in, and these mines that I have just enumerated were all connected with it, could they not carry on their prospecting works at an immensely less cost than now?

A. Most assuredly they could.

Q. Would they have to pay anything to the Tunnel Company while they were only prospecting and taking out no ore?

A. They would have to pay no royalty.

Q. In fact, would they be compelled to pay anything? Would it not be optional with them to take out the rock by shafts, or any way they pleased, and still get the benefit of the tunnel for drainage and ventilation?

A. Yes.

Q. That is the way you understand it. Consequently, the tunnel would be of immense benefit to those parts of the Comstock lode which are unproductive?

A. It would save the expenditure of a good deal of money for purposes of drainage and ventilation.

Q. Would you then, Doctor, consider it fair to make this comparison in this report here in regard to the cost of hoisting the ore and pumping water?

A. The statement in that report is made with reference to the paying rock that was removed. We hadn't the data to

arrive at anything like an estimate of waste rock, and it is especially stated that that was an element that should be included, but is not.

Q. Yes; but not being included, is that a fair comparison, to give the cost of working, as they do, at \$1,035,000, and at the lowest estimate through the tunnel at \$1,169,000. Would you consider that a fair figure?

A. It would be a fair figure, if we could have made the addition of the refuse rock, (there are three, and perhaps five tons of refuse rock where there is one worked.) I insisted on having that included in the amount, or requested that it might be done rather; but we couldn't arrive at it, and it was considered sufficient to make the general statement that that is not included, and that it is a large amount.

Q. Well, if you would have included all the workings of the mines which had no ore, wouldn't that sum of \$1,035,000 have been very largely increased? Instead of \$1,000,000, would it not have been nearly \$3,000,000, if you had included the expense of all these prospecting mines?

A. We could not bring the elements of computation to bear upon where they were not working or producing nothing. We got from the superintendents the basis of the calculations, supposing that they would give it accurately. They mentioned, as was evident to our eyes, that vast amounts of country rock had to be raised and thrown off and dumped. The computation was really for working where the rock was rich, entirely so, with no refuse matter; and it was so stated in the report. It doesn't give a fair estimate of the actual expense.

Q. But looking at the statements of these superintendents, from the general information that you could gather, that they were opposed to the tunnel, no matter whether from their own opinions or from the opinions of others, would it be fair to take these statements altogether for granted as correct?

A. We had to get the best material we could. They looked like honorable men, honest men, strongly prejudiced

against the tunnel. We gave their statements for what they were worth. We were under the necessity of making an estimate, and we had to use such data as we could procure. It would, in my opinion, have been right to include the waste rock that was raised as well as the paying ore.

Q. Well, Doctor, don't you think there are honest Republicans and honest Democrats? Would you think it would be fair to the Republican party to take the opinion of a Democrat about it, or the reverse?

A. Well, I shouldn't think of doing such a thing.

Q. Well, that opinion would be a good deal like the statements of these superintendents over there, who are entirely opposed to the tunnel. They belong to a different party, and it would hardly be fair to the tunnel to accept their statements about it, and make them the basis of a report.

A. We were obliged to work from the figures we could procure.

MR. SUNDERLAND. I suppose the facts are the same, whether stated by a Republican or a Democrat.

MR. SUTRO. We have gone through those facts pretty well. Doctor, I want to ask you one or more questions in connection with this report here. Mr. Day, in his report here, states, that there will be great difficulty in getting in these men on a railroad; that there will be great confusion, etc. Do you think that there would be any difficulty in taking in a thousand men at a time, stopping the train at each shaft, and letting off the cars containing these men?

A. I shouldn't think there would be any difficulty. There would be the same difficulty, perhaps a little more than we experience in receiving and landing passengers on a railroad.

Q. He furthermore states, that they will have to climb up ladders, and that they will get to their work in an exhausted condition, positively unfit and unable to do a day's work. Have you seen a drawing of this apparatus for hoisting men and lowering rock?

A. Yes, sir.

Q. Can you see any difficulty in its operations?

A. No more difficulty than by the present way of hoisting ore and lowering men.

Q. Then he speaks about a "tedious, slow, and expensive route," over which the timber is to be brought in. Do you see any difficulty in carrying in timber on a railroad train, having your cars loaded, and delivering it at these shafts, and then hoisting up the timbers the same as they are now lowered down?

A. I cannot see where the difficulty would exist, or where there would be any real difference between hoisting and lowering the timbers. I thought a good deal upon that subject, because it was made a strong point, and was pretty thoroughly discussed.

Q. Then he says that, in case there should be a cave threatened in the mine, the order would have to be sent down a ladder to get to the tunnel, and then away out to the mouth, five miles, and that a great deal of time would be lost in that manner. Do you consider that much time would be lost in running in these timbers on a railroad train going at the rate of ten miles an hour, when you can carry in as many thousand of feet as required?

A. Well, I suppose from the time of giving the order to the delivery of timber there might be from thirty to fifty minutes. That is, to get it in.

Mr. SUNDERLAND. From what point, Doctor?

Mr. NEWCOMB. Four or five miles off.

Mr. SUNDERLAND. To any one of the mines in the Comstock?

Mr. NEWCOMB. Anywhere within a range of five miles.

Mr. SUTRO. The tunnel is not quite four miles in length, and a mile or a mile and a half either way would reach any mine?

Mr. NEWCOMB. An hour would be the outside of the time required to get timbers in. They could have a telegraph established between the interior workings of the mine or the tunnel to the mouth of the tunnel.

Q. How many men do they lower at a time into these shafts?

A. Well, now, that's a peculiar question. It depends entirely upon the sizes of the men.

Q. How many ordinary-sized men? How many do they ordinarily take?

A. I think there were six when we went down in the cage.

Q. Were you packed in pretty close?

A. Well, we were pretty large-sized men, with the exception of myself and two others.

Q. How long do you think it would take to let a cage down with a lot of men, taking the speed at which they run cages when men are on them, leave the men at the bottom, and hoist up another lot?

A. How deep would you go?

Q. Say 2,000 feet; down to the tunnel level.

A. Well, I think the cages would average six men each. I have tried the elevating of material, not men; they vary, but I have a sort of approximation.

Q. There is a very great difference between lowering rock and lowering men. They are more cautious with men?

A. I am aware there is a difference. They lower slower with men on.

Q. How much time do you think it would take to lower a set of men to a depth of 2,000 feet?

A. I shouldn't think it would be safe to lower a cage down that far certainly in less than five minutes. It could be done quicker.

Q. Say five minutes to go down and five to come up. Is that your statement?

A. If loaded, yes.

Q. Well, there is ten minutes; and you say six men go on a cage. Suppose you have to let down a thousand men in one shaft.

A. There are six men on a cage, but they can carry more than that. They can run them down safely in two cages.

Q. Have you ever seen a double set of men go down? How many men have you ever seen on a cage at one time?

A. I have seen them come up double.

Q. How many at a time?

A. Twelve. I think there could not have been more than twelve. Perhaps it might have been a less number.

Q. Well, taking your maximum number, twelve even, it would take them eighty-three trips to get down. That would make, at ten minutes, fourteen hours to take down a thousand men at one point. Now, in going down——

MR. SUNDERLAND. I want to know if the Doctor assents to that: If he does, all right. I want to have his testimony.

MR. NEWCOMB. I don't vouch for the calculations.

MR. SUTRO. The Doctor has stated that twelve men go down at one trip, as a maximum. There are a thousand men, which would make eighty-three trips and a fraction over. Is that right?

MR. NEWCOMB. It would be a little over eighty-three trips.

Q. At ten minutes each, it makes 830 minutes, don't it?

A. Yes, sir.

Q. Well, that makes 13 hours and 50 minutes. Is that right?

A. It would be 13 hours 50 minutes.

Q. Now, when these men get down there, why, they have got to go to their respective places and change shift, and then the other men have got to come to the cage and be hoisted out; that would take as long again, would it not?

A. Unless their arrangements were so perfected that they could meet at the shaft. Unless they should have a specified time, and take that time from the work, the one force would be under the necessity of going to the heading to relieve the other; but by special agreement they could meet at the point of raising.

Q. Then, if they were to meet there, it would take only

13 hours and 50 minutes to lower down 1,000 men and hoist another thousand up?

A. Yes; they could run up 1,000 and carry down 1,000 in 13 hours and 50 minutes.

Q. But if these 1,000 going down were to go to those at work and change shift, it would take another 13 hours and 50 minutes to get the 1,000 up?

A. Yes. The time spent in coming from the heading, after being relieved, might be long or short. It would depend upon the distance. There is no computing it accurately. It is mere supposition.

Q. Doctor, I want to ask you one more question about drainage: Can you see any difficulty in making bore-holes from these shafts, to connect with the tunnel below, supposing the tunnel to be completed—bore-holes such as are made in the oil regions?

A. There is no special difficulty that I can conceive.

Q. Supposing that were done, would it not at once relieve the mines from all necessity of pumping?

A. Certainly it would.

Q. While they are prospecting and taking out no ores, these mines would get that drainage and their ventilation for nothing, would they not?

A. For nothing, as I understand it.

HEARING MONDAY, FEBRUARY 26.

Cross-examination of Professor Newcomb.

Mr. SUNDERLAND. My examination to-night, Doctor, will have to be a little desultory. I will ask you, first, if you visited the Sierra Nevada?

Mr. NEWCOMB. We did, sir; but we didn't go into any of the diggings except on the surface. We looked at those.

Q. Are there any diggings except on the surface?

A. Well, from the books we learn that they have made excavations without finding anything of value below the surface.

Q. The mining is on the surface?

A. Yes, and it is altogether for gold.

Q. Was there any water in that mine?

A. I don't know how it has been this winter.

Q. Well, when you were there?

A. Of course there was none on the surface.

Mr. PAYNE. Is this a mine or a mountain that you are talking about?

Mr. SUNDERLAND. It is a mine. It is a mine that now embraces not only the Sierra Nevada originally, but a great many others that have been mentioned here, among which are the Allen and the Sacramento—all the mines north of a certain ravine there, except an old shaft north of the Sierra Nevada, the one that Mr. Sutro opened. It was located in 1860, and named after Mr. Sutro.

Mr. SUTRO. They opened it and took out some ore there, but I don't think it has been worked for some years.

Mr. SUNDERLAND. The Sierra Nevada——

Mr. NEWCOMB. The Sierra Nevada is emphatically a gold-mining company, working from the surface. That tells the whole story.

Mr. SUNDERLAND. It has consolidated with, and acquired by purchase, all the mines north of the ravine, with the exception of one.

Mr. SUTRO. It hasn't got the Allen or the Utah.

Mr. SUNDERLAND. It hasn't got the Utah, but it has got the Allen.

Mr. SUTRO. I wasn't aware of that.

Mr. SUNDERLAND. The Allen and the Utah and the Sacramento and the Meredith, and I don't know how many others, belong to it.

Mr. PAYNE. You say it hasn't got the Utah?

Mr. SUTRO. No, it hasn't.

Mr. SUNDERLAND. That is farther north, and probably don't conflict with it at all.

Mr. NEWCOMB. It's of no consequence about that class of mine. It yields tolerably well from surface digging.

Mr. SUTRO. You wouldn't call that a placer mine? That is not a part of the Comstock.

Mr. NEWCOMB. It would come nearer to placer digging than to actual mining.

Mr. SUTRO. In other words, they take off the surface and work it. It isn't a part of the Comstock proper. It isn't really the Comstock lode.

Mr. NEWCOMB. Well, we understand that the Comstock extends even beyond that point.

Mr. SUTRO. But is this not of the character of placer diggings where they are taking that ore from?

Mr. NEWCOMB. It's surface digging. That's enough. They are excavating from the surface, and working for gold, not silver.

Mr. SUNDERLAND. Do you consider the Sierra Nevada mines a part of the Comstock or not?

Mr. NEWCOMB. It is a part of the Comstock, or it is on the Comstock, whichever you choose.

Mr. KENDALL. You would consider it, Professor, the croppings of the Comstock lode, perhaps?

A. The character of the rock is different from what we get as we pass down. It is very likely washed from some little distance. It is emphatically gold mining; nothing else.

Mr. SUTRO. I would like to ask one question right here,

in explanation of this reference to the Sierra Nevada mine. I wish you to say whether you consider that, under our contract, we can collect our royalty from the Sierra Nevada mine?

A. That would be a matter to be decided by the courts.

Mr. SUNDERLAND. Isn't that a body of quartz there?

A. Well, it is broken-up rock, as near as my memory serves me. It is a mixture of rock of different kinds: not rock, but broken-up material. There is quartz in it, of a reddish color, if I recollect right. We didn't examine it very critically.

Q. Of a reddish color?

A. I think so.

Q. Don't you know that always on the surface of the Comstock the rock has been red, and distinguished by the pitch and by the color from the other bodies of the lode—called red ledge?

A. I know there is what is called the red ledge, and that there is what is called the red quartz, on the Comstock.

Q. Isn't this similar to the red ledge on other portions of the Comstock?

A. I didn't make the comparison. I should judge that it was the same, as near as my memory serves me, but I will not be positive.

Q. I think you stated on Saturday night that that ore yielded from \$15 to \$20 a ton, did you not?

A. I didn't say what the Sierra Nevada yielded. We made inquiries in regard to it. The yield is small, but I consider it to be profitable working, because of the simplicity with which operations there may be carried on.

Q. I will read now from Mr. King's report, page 167:

"During 1869 the company produced and milled 18,000 tons of rock, yielding \$155,791 36, or an average of \$8 66 per ton. The expenses per ton were as follows:

For mining.....	\$1 92
For milling.....	3 03
For incidentals.....	77

Making a total of.....	\$5 72
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and leaving a profit of \$2 94 to the ton."

Of what benefit to that mine could the Sutro tunnel be?

A. None at all, as I consider, sir; not a particle.

Q. Now I will call your attention to the Chollar. That, I suppose, you visited and examined thoroughly?

A. Yes, sir; the Chollar Potosi.

Q. When I mention the Chollar, I mean the Chollar Potosi. How deep are they working that mine at present?

A. Mining was not carried on when we were there on low levels. It was on the upper levels that they had productive rock.

Q. How deep are they working at present?

A. We did not go into any of the lower levels. We went into the upper levels alone. I haven't marked down the depth to which they have run. I think it was stated by Mr. Requa that they had sunk shafts to a depth of 1,100 or 1,200 feet. It is merely a matter of memory with me.

Q. It is almost 1,250. But they are not working except on the surface?

A. They were not working except on the upper levels. They had a body of ore that they were working that paid remarkably well. It was upon the upper levels; and they expended their force upon it during the year, and made their profits.

Q. Now, can you tell me how deep they were working when you were there?

A. I cannot. About 500 feet, I suppose. I don't recollect exactly.

Q. Do you think it exceeded 300?

A. It might not have been. It may have been 300, 400, or 500 feet that we went down.

Q. Was there any water in the mine?

A. None to produce any disturbance.

Q. Was there any to require pumping?

A. I think not.

Q. How was that ore taken out. Was it through a shaft or through a tunnel?

A. Through a shaft.

Q. All of it?

A. All that we knew about.

Q. From what depth was that hoisted in the shaft?

A. It was taken out from the levels upon which they were working. I don't recollect whether they were 300 or 400 or 500 feet deep.

Q. It was 178 feet, as stated by Mr. Requa in his report to you?

A. Well, I don't recollect the precise number. I can't carry all the figures in my mind.

Q. Could the Sutro tunnel be of any benefit to that mine, so far as there is any ore in sight; so far as you could see any ore?

A. It would be cheaper to raise the ore there to the surface than to pass it through the tunnel, if the reduction works could be made equally valuable with the reduction works at the mouth of the tunnel.

Q. I am talking about the mining and the drainage?

A. The mining could be accomplished as cheaply by elevating the ore from that depth as it could if it were dumped into the tunnel, and carried out to its mouth.

Q. How would you lower the ore from the Sierra Nevada or the Chollar Potosi, from the points where it is found in those mines, to the level of the tunnel, taking into consideration the dips of the west wall of the vein?

A. So far as the Sierra Nevada is concerned, it would be preposterous to throw the ore from the surface down into the tunnel. It would require a great deal of excavation, in order to get at the tunnel, in the first place. It is a surface working. With reference to the other mine, unless ore is discovered in low levels, as it may be in the future, it would be of no great utility.

Q. Would it be of any utility at all?

A. Mr. Requa states, in his report, that there is enough of ore in sight to make it profitable for the coming year. At the rate of the previous year's workings, by the close of the year the ore would all be worked out of the upper levels.

Q. I have not his last report. Somebody has borrowed it, I think, from my room. I believe there were 83,000

tons worked the year previous to the time you were there. The report was made probably when you were there?

A. Yes.

Q. The royalty on that would be how much?

A. Two dollars a ton, of course.

Q. That would be \$166,000, would it not?

A. Yes.

Q. Would there be any recompense to the company for that royalty?

A. Well, there would be none unless deeper diggings are made. If they find a bonanza upon a lower level, there might. They confine themselves now comparatively to the surface. The advantages that would accrue from the tunnel would be to enable them to examine their mine with greater facility than they can now, saving them extensive drifting, saving them going down in their different shafts, that they sink for the purpose of exploring and working from. It would determine for that mine whether the ore exists at a depth of nearly 2,000 feet.

Q. You say it would save extensive drifting. Do you know how near the west wall Mr. Sutro's contracts require him to go?

A. I did know. I think 150 feet.

Q. It is 500 feet.

A. Well, you can go any distance within 500 feet.

Mr. SUTRO. It is optional.

Mr. SUNDERLAND. Are men in the habit of doing more than their contracts require when working under contracts?

Mr. NEWCOMB. Not as a general rule; but there are exceptional cases.

Q. If Mr. Sutro gets the same royalty by going within 500 feet of the west wall as by going nearer, would you expect him to go any nearer with his tunnel?

A. It would cost no more.

Q. Why not?

A. Why should it?

Q. I ask you the question. You don't ask me.

A. I will explain here that the only point made in connection with it is the dip of the lode. The lateral tunnel running along the ledge should be placed at a sufficient distance to give working operations directly down upon the lode at lower depths. It is important that the position should be so far from it as to enable direct shafts, instead of inclines, to be run for the purpose of working favorably in making investigations at lower depths than 2,000 feet. If placed at 150 feet distant, it would strike the lode at a depth of 150 feet, if the angle of the rock is 45 degrees. But if farther removed, say at 500 feet, why it would give that depth perpendicular; so that it is left optional, as I understand it, with Mr. Sutro, in running through the propylite, to go within 500 feet, or nearer to it, as he finds the most advantageous.

Q. Where do you learn, Professor, that it is optional with Mr. Sutro whether he will go 500 feet or not? Where did you get that idea of 150 feet?

A. Because we talked the matter over in the commission, and made minutes in reference to it. I may be mistaken about the 150 feet; but we determined upon a point intermediate.

Q. Did your determination compel Mr. Sutro to run within 150 feet of the west wall?

A. No, sir. I suppose it will be according as he finds it of utility. Men are generally governed by their interests, and they will work undoubtedly for their interests in connection with this matter.

Q. How do you say it won't cost any more to run within 150 feet of the west wall than to run within 500 feet? That is a difference of 350 feet. At the size he is required to make his tunnel, what would it cost to run it 350 feet?

A. It might cost more to run it in consequence of keeping upon the vein of ore. Otherwise, if the divergence of the vein were toward the syenite, or to the west, instead of to the east of the vein, he might run it in a direct line, right upon the vein, still farther to the north. In running to the south, this vein matter is not entirely in a right line.

It varies a little from a right line. It is a matter for the parties working to determine what will be for their interests and the interests of the miners, because both their interests will become identical.

Q. Have the owners of the Comstock anything to say about where he shall run his tunnel, if he runs it within 500 feet of the west wall?

A. They might object to its running, if it isn't run in the vein matter.

Q. Have they anything to say about what distance he shall run it towards the west wall, if he runs it within 500 feet?

A. Not that I am aware of.

Q. Then it is left to Mr. Sutro to say whether he will run it within 500 feet or 100.

A. To the Sutro Tunnel Company.

Q. You were speaking the other night about the use of compressed air as a motive power for any machinery located on the level of the Sutro tunnel as a base of operations for a deeper working.

A. It was to manufacture compressed air, and use it together with the water power furnished by the water found in the mines.

Q. Do you know anything about the regularity of the water found? Is there any regular supply in any one of the mines?

A. I think it is very variable, and that variation is due in great measure to the amount of rain and snow that falls in the winter. It would be large in one season and small in another.

Q. Do you not know, Professor, that the supply of water is more owing to the tapping of reservoirs of water underground, and exhausting these reservoirs, than to anything else?

A. I know that when they strike a clay seam it is not a very uncommon event to be flooded. I think it commenced in the Savage, and extended in the drifts be-

tween that mine and the Hale and Norcross while we were there, and flooded both.

Q. The Hale and Norcross was lower than the Savage, and the water from the Savage ran in. That was lower when you were there?

A. Not so that we could enter the mines. It was understood to be under control while we were there.

Q. Do you know how deep the Savage shaft was when you were there.

A. I do not.

Q. Do you know how deep it is now?

A. No, sir; I have no means of knowing, because I didn't visit the mines at all.

Q. Do you know of your own information whether they have been sinking it since you left?

A. I have information that they have been going down, and have struck a bonanza.

Q. Do you think that the supply of water from the mines alone is sufficient to rely upon for any motive power? Do you think it is sufficiently regular?

A. Not without the formation of reservoirs. They may form reservoirs on the 300-foot level to catch all that comes down. Where you have a column of water 1,500 or 1,600 feet high, it requires a very small amount of it to move a turbine wheel.

Q. Then would you rely upon the water in the mines to any considerable extent for power at the mouth of the tunnel?

A. No. I think there is enough water poured out from the mouth of the tunnel, however, to do a great deal towards concentrating and working the ores. There was a pretty large stream of water running from the tunnel at the time we were there, but I should judge not sufficient for water power.

Q. Did you examine any of the tunnels that had been or were being run, while you were there, by the Virginia City and Gold Hill Water Company, to procure water for the Comstock?

A. I was in one tunnel that they had purchased; at least the party told me that he had sold the water-right.

Q. Do you recollect the name?

A. Whatever it is, it lies right back of the Crown Point, in the Crown Point ravine.

Q. Do you know anything about the regularity of the flow of water in those tunnels that have been or are now being run by the water company?

Q. I should judge it would vary very materially, for the reason that I assigned with reference to the other matter.

Q. You regard the water found there as surface water, do you not?

A. The greater part of it, with the exception of that which has been, for we know not how long, inclosed in those pockets that we have spoken of. I know, in descending the shafts in some places, the waste water dripped upon us; it came down in quite a stream, as we were going down the shafts, from the upper surface.

Q. You found no subterraneous streams anywhere that you visited, did you?

A. Not there.

Q. Anywhere on the Comstock?

A. No. The accumulations of water would be in some cases running, but there were not properly called subterranean streams. They were the results of the excavations where I saw running streams. I will try to give you the name——

Q. It isn't material. I just wanted to know its location; that is all. For the purpose of compressing air, if there was a sufficient supply of water on the surface of the Comstock, with sufficient fall, couldn't that be better utilized than anywhere else in the Comstock or at the mouth of the tunnel?

A. It is to be utilized at the mouth of the tunnel, as I understand the proposition. It is to be utilized in the mines for further excavations.

Q. That is one of the propositions?

A. The compressed air, as I understand it, is carried

from mouth of the tunnel into the mines. It is compressed by water power.

Q. Would it not be much cheaper, having water on the surface, or at a sufficient elevation at the tops of these shafts, to compress the air by means of that water power there and send it down below, and afterwards use the power for any purposes required?

A. That would be pumping the water up. The question is one of profit and loss in the transaction. The probability is that it would take as much steam power to raise the water as you would get water power advantage.

Q. Supposing you have water power, Professor, on the Comstock to compress the air and send it down to the tunnel level, would it not be much cheaper than to compress the air by water power at the mouth of the tunnel and send it in four or five miles? Wouldn't the loss be much less?

A. There is friction in the air passing through tubes; there would be loss of power in sending it in through the mouth of the tunnel, yet the directness of it, with the use of an abundance of water power, which is the cheapest of all power that we are acquainted with, would render it an object to send vast bodies of air through the whole extent of the mines, which is perfectly practicable from the mouth of the tunnel; and that would be cheaper than to manufacture it by steam power and send it down by the shaft.

Q. What did you say that the loss was at the Hoosac tunnel in a mile?

A. That I have forgotten.

Q. I think you stated about 15 per cent.

A. Almost 15 per cent. in running a mile and a half.

Q. What would be the loss, then, for the length of that tunnel?

A. That would be a matter of speculation. It would depend upon the size of the tube that you send it through. There would, of course, be considerable increase over that amount.

Q. Wouldn't it be the same per mile?

A. No, sir.

Q. Why not?

A. In sending it that distance the tube would be very much larger. The water power would cost nothing. If you take a small tube, of course friction upon the surface and sides would be much more than in a large tube.

Q. Then you would improve upon the tube used at the Hoosac tunnel?

A. That tube was large enough. They sent it from a distance of a mile and a half, and were then generating it by steam.

Q. I am talking now about the use of water power alone for compressing the air. What would be the difference in distance from the top of these shafts down to the 2,000-foot level, and from the mouth of the tunnel into each mine on the Comstock?

A. Well you might make an average of five miles. It would be about that.

Q. From that should be deducted, say 1,600 feet, the average depth of the different shafts. Would the percentage of loss be the same, in proportion to the distance from the mouth of the shaft down, as it would from the mouth of the tunnel in?

A. That is a question that I am not clear upon. If it were passing in horizontally, it would go with greater facility than by forcing it down. It seems the resistance would be greater, and yet it may be a mistake.

Mr. SUTRO. Mr. Sunderland, will you permit me to ask one short question. How are you going to get water power at Virginia City, at the top of the Comstock?

Mr. SUNDERLAND. I will ask that question myself. Did you hear anything, Professor, about a project to bring water in from the eastern slope of the Sierra Nevada mountains to Virginia City while you were there?

Mr. NEWCOMB. Yes, sir; it was talked of by the water company. Whether it has been accomplished or not, I don't know.

Q. Do you know anything about the practicability of that project? Did you examine it to ascertain?

A. No, I did not. It didn't belong to our particular province to investigate it.

Q. Suppose that water should be brought in by the water company in an abundant supply, would it not be cheaper then to use that water for compressing air and sending it down the shafts than to use the water of Carson river at the mouth of the tunnel and send it in, on account of the great difference in distance?

A. I should think it would, if they had an abundant supply of water without cost.

Q. Yes, sir; but I don't suppose you would get the Carson river without cost.

Mr. SUTRO. They sell water now at Virginia City at \$1,000 an inch per month.

Mr. SUNDERLAND. I don't think any body will get the water without cost.

Mr. NEWCOMB. I am only speaking on general principles. Water power is generally cheap.

Q. But the Carson river is private property wherever it has any fall, and will not be acquired by any body without cost.

A. I think that proposition of yours will hold good. I think it will cost a good deal.

Q. You mentioned the Monte Christo mine, or the Monte Christo ledge; which is it?

A. The Monte Christo lode.

Q. That is the ledge upon which you suppose the Lady Bryan mine to be located?

A. Yes, sir. The tunnel would be of no service to that without a branch tunnel upon the lode; that is the Lady Bryan mine.

Q. How far would the tunnel be from the Lady Bryan mine?

A. I should judge a considerable distance.

Q. Two miles?

A. I don't know. I have no idea of it.

Q. You mentioned the Lady Bryan several times the other evening, Doctor, and therefore I want to make some explanations.

A. Only with reference to the probable yield upon the lode.

Q. That is north of the Seven Mile cañon, is it not?

A. I don't think—

Q. That is, below the Gould and Curry mill?

A. Yes, sir.

Q. Do you know whether that lode has been traced south of the cañon anywhere? Did you find it anywhere?

A. Let me see. I think there is another mine upon the Monte Christo, upon the line of the tunnel—the St. John mine. I think that is on the Monte Christo.

Q. Why do you think that is upon the Monte Christo?

A. Because their croppings indicate it.

Q. Are not the St. John and the Occidental on the same lode? Cannot you follow the croppings from one to the other?

A. I didn't trace the croppings through. It is possible they may be followed.

Q. You didn't examine very particularly, then, to see whether the Occidental and the St. John are upon the same lode or not, did you?

A. No, sir; I did not. It was a matter of secondary importance. We followed over the track of the tunnel. The Lady Bryan lode is laid down upon the map here as not being upon the Monte Christo lode, but upon the Great Flowery range; and the St. John is on the Monte Christo.

Q. Has any connection ever been traced between any mines north of the cañon, Doctor, and those south of it, without naming them at all? Is there any connection at all between them?

A. I can't say there is, because it was a matter that we didn't feel in a condition to investigate at the time.

Q. Then do you think, as far as the Lady Bryan is concerned, that the Sutro tunnel would be of any benefit to it?

A. No; I should not think it would be of any service

scarcely, unless they discover, in crossing the track of the Great Flowery lode, the presence of rich rock, that might pay for extending, as a distinct and separate operation, the tunnel along the track of the Great Flowery, up to the Lady Bryan.

Q. Do you know what amount of base metal there is in the Lady Bryan mine?

A. I do not.

Q. Did you notice that the metal is base?

A. No, not particularly. I have specimens of it, but I haven't analyzed them at all.

Q. The mining there has generally been done near the surface, has it not?

A. Oh, it is an immense amount of quartz. It is on the surface—on a mountain that rises up. They have extended it in places by perforating the hill. Whether it is profitable or not I can't say. When we were there they had struck through the great mass of the rock into an interior cavity that was open to the air; the excavations there were very large, and they had moved it through a sort of an opening or tunnel to the outer side. It may be called, if you please, surface digging.

Q. What was your information as to the success that company had had in mining?

A. Well, the company had gone to the dogs, and had passed into new hands, as I understood it.

Q. It had been unsuccessful, had it not?

A. Yes, sir; so I understood. It had passed into new hands.

Q. Yes. Sorry for it. Well, now, Doctor, we have had considerable information from you about mines and milling. I will ask you what is the extent of your experience either in mining or milling ores? Where have you mined?

A. I have had considerable experience in placer mining.

Q. I am talking now about lodes, quartz lodes, containing precious metals. Where have you worked any mine of that character, or where have you milled any ore of that character?

A. I haven't worked in any lode whatever, either as a miner or as a mill-man. I have examined a great many mines, but never have worked in them.

Q. You have never superintended the working of a mine or mill? I am talking now about a quartz mine or mill.

A. No, sir.

Q. You spoke the other evening about the concentration of ore at the mouth of the tunnel, and said that by that means, with proper machinery and abundance of water, the expenses of reducing ores would be much less than by the present mode. I will ask you, Doctor, what machinery you speak of when you say "proper machinery?"

A. I mean the machinery that they have in operation extensively in Europe, especially on the southwest end of England, where they are digging a good deal of ore, and the machinery that they have in Germany, where they work ore that is represented as yielding, by assay, from \$7 to \$10 a ton at a profit, or even less.

Q. What machinery is necessary to concentrate ores?

A. It should be of different kinds, of an automatic character, so as not to require the use of hands. The saving in the question of labor is one important item.

Q. Just explain to the committee what kind of machinery you mean, and what is the process? You say it is of various kinds; commence with the first, then, if you please.

A. It is hardly worth while, sir, to give all the different modes that are proposed. In Europe they have it systematized in such a manner that the ore passes through a regular series of operations, so that what one part of the machine loses another saves. I have witnessed the process in the zinc mines of the East. One of the machines that they use in Germany is so arranged that a constant stream of water passes in from below upward, keeps the matter agitated, and throws the lighter substances out. A succession of these machines is required for working the precious metals. Then there are turn-tables, by which is maintained a circular movement, to stir the metal particles; a small amount of water pouring upon them to wash away the un-

productive portions. There are various concave and convex pans of this description. We should use all the improved appliances in connection with this system.

Q. That is just what I want to know. I want to know what those appliances are, because we on the Comstock are anxious to find out how we can save the metal?

A. You will require more than you have at any of your mills to accomplish that purpose at the present time, I suppose. Their works in Europe cover, in some portions, a large extent of surface; they have very gradual descents, that I don't know of any of your mills possessing, that are located in the ravines. You don't get the fall which is necessary, in order to have an automatic process of working.

Q. I believe you say, in your report, (page 12,) that, in all the mines you have visited, you haven't found any means for concentration used that are applicable to the concentration of the ores on the Comstock?

A. I started with the commissioners to investigate the matter of the reduction of zinc, the concentration of the ores. They have their concentrators at a place in New Jersey called Franklin, where these mines exist. We saw the different operations carried on there, not with any degree of nicety, for the simple reason that the ore was scarcely worth the trouble. I am acquainted with the party who put the machines up. He was a mining engineer, and has worked many years in the mines of Germany. He said that for gold and silver he could bring his machines down so as to work them closely. In zinc there is quite a loss of the material by the process; but if they were to go to working it finer, they couldn't work so rapidly.

Q. Well, do you still uphold your report, when it is said in it that you haven't seen any machines at the mines that you visited that are applicable to the concentration of the ores on the Comstock? Is that so, or not?

A. The machinery that we saw is not applicable, excepting with this improvement. With this improvement,

I believe, it would be applicable to the mines on the Comstock.

Q. Have you ever seen gold or silver, or gold and silver ores concentrated anywhere?

A. I have seen them on the Comstock lode. There they are at work all the time concentrating.

Q. By the machinery that you speak of?

A. By the machinery you have there. It is a sort of a concentration.

Q. But it is not the improved machinery of which you speak?

A. No, sir. I didn't see any of that there.

Q. Your recommendation in the report, Doctor, I believe, is upon the supposition that the ore will be taken from the Comstock through the tunnel and reduced at its mouth?

A. Yes.

Q. Otherwise, it would be of no considerable benefit to the Comstock?

A. At the present time I think the tunnel would be an entire failure, to just take the ore and dump it at the mouth of the tunnel. I believe it would be more difficult, really, to take the ores from the mouth of the tunnel and deliver them at the mills, especially in the cañons, carting them up hill, etc., than to hoist through the shafts as at present. That is the conclusion that we arrived at unanimously. But the circumstances are entirely changed when you have your reduction-works at the mouth of the tunnel.

Q. Now, what do you know of the practicability of the Sutro Tunnel Company, or anybody else, getting control of the waters of the Carson river, so as to erect reduction works at the mouth of the tunnel.

A. I don't know anything about it particularly, except that men generally act from interested motives, and if they can get a very much larger percentage of their ore saved to them, and superior accommodations to anything they now have, I suppose they would be willing to make an exchange of their positions on the Carson river for posi-

tions at the mouth of the tunnel. It is merely supposition, reasoning upon the principle laid down in human nature.

Q. Do you know that all the water power on the Carson river above the mouth of the tunnel is now taken up?

A. Well, I know that a considerable amount of it is, but how much I cannot say. I don't think the whole, by any means.

Q. Do you know of any considerable fall in the river there sufficient for a water power that is not now occupied?

A. Well, I cannot say that there is any. It would require a lengthy survey of the whole extent of it.

Q. Is it not cheaper to utilize that power on the river, by a succession of dams, than it would be by building one large dam, and take all the water out at one place?

A. It is much cheaper to build small dams than large ones. That we understand, if that is what you mean.

Q. Is it not much cheaper to use the water power by a succession of dams than to build one immense dam?

A. Well, if you get the same amount of fall, one is as good as the other.

Q. I am not talking about how good they are. I am talking about the cost.

A. It depends upon how many dams you construct. It's an open question. There are no elements of computation.

Q. You think not?

A. I don't see that there are any. A hundred small dams may cost more than one large dam.

Q. You speak of building a dam here that will form a reservoir, and dam up the water. I believe there are eleven miles in the distance; that is my recollection.

A. Up to the Mexican mills.

Q. Do you know what property that will overflow and destroy?

A. I don't know of any very valuable property on the route.

Q. Are those mills that you destroy of any considerable value?

A. The mills that you take the water power from are some of them of considerable value.

Q. Don't you take the water power from all the mills on the Carson river?

A. No, sir; you don't disturb the Mexican mill. That is one of the most important.

Q. Did you visit the Eureka mill, that was in process of construction while you were there?

A. No; I think it was just commenced.

Q. Do you know the estimated cost of that mill?

A. No.

Q. You were not told?

A. No; I was told they were putting up a fine mill.

Q. You don't know its capacity?

A. I don't know its capacity.

Q. Did you visit the Brunswick mills?

A. I think I did. I think we visited the Brunswick, and it was a very pretty mill, too.

Q. The Brunswick was being reconstructed while you were there. It was the second below the Mexican mill.

A. I think we were taken there, but I won't be positive.

Q. The dam was raised and the capacity of the mill doubled. It was in process of reconstruction while you were there. It was not completed.

A. I think we were there.

Q. It is on the line of the railroad. You run between the mill and the river?

A. We probably stopped there. We had a special train to go in. We stopped, I think, at the Brunswick mill.

Q. Do you know of any other property beside the mills that you destroy? You destroy all the mill power below the Franklin dam; you take all the power away from the other mills?

A. Certainly.

Q. Do you know what other mills are below?

A. No. General Foster took a memorandum of them. I did not.

Q. He says he turned it over to the commission. He suffered it to be in the hands of General Wright. I asked him a good many of these questions, and he made that answer. Do you know anything about the feasibility of forming reservoirs in the mountains, by means of small dams at favorable places, where the water may be preserved until it gets low in the river?

A. I haven't been in the mountains sufficient to determine that matter, but generally where there are deep ravines and small streams of water these reservoirs can be formed. It's a matter I didn't investigate.

Q. Would you think it probable that the water could be as well preserved in the dry season that way as by building this immense dam that you speak of?

A. Well, if you furnish the power at the mouth of the tunnel you attain the same result that you do by building one big dam. I don't think you would have water enough in the ravines that are there to effect the object.

Q. The ravines form the river, don't they?

A. Yes. You would have to conduct the water in your sluices from a great distance.

Q. Why sluices? Why not let the water run down the channel it runs in now?

A. Reservoirs may be formed to a limited extent in the way you say, undoubtedly.

Q. Suppose dams were erected at favorable locations in the mountains, and the water retained there in reservoirs until the dry season, wouldn't they furnish water for the running of the present mills in as great abundance as it would be furnished by the reservoirs contemplated in this large dam?

Q. If you could secure all the water advantages, there is no doubt about that—if you would save it and give no more surface for evaporation.

Q. Do you suppose this dam would save all the water which runs down the Carson during the wet season?

A. No, sir; I hardly think it would. It would save a vast amount, but not all of it. It becomes a turbulent stream sometimes.

Mr. SESSIONS. What is the fall per mile?

Mr. NEWCOMB. Well, it varies.

Mr. SUNDERLAND. I think, according to the statement of Mr. Day, it is about 250 feet in 15 miles, by the meandering of the river. It isn't that distance (15 miles) in a straight line. I don't now remember myself. I suppose Mr. Day's statement is correct. At any rate, I don't care about disputing it. Do you not know, Doctor, that Empire City would be destroyed by the erection of this dam to the height contemplated?

Mr. NEWCOMB. It would depend upon the height of the dam.

Q. You have given the height of the dam here.

A. I think it would flood the city, but my remembrance of that place is, that the loss couldn't be very great if the whole of it were submerged. The most of it is the mill and a few houses.

Q. I don't know how valuable it may be to the Sutro Tunnel Company. I know it is very valuable when a railroad runs through it. I have had some experience in that. There are two or three hundred inhabitants there, are there not?

A. There are 200 or 300, I suppose, working in the mills.

Q. Living in the town?

A. Living in the town, on the hill-sides, in the valley; yes, I should think there were fully that number.

Q. You stated the other evening that there was no room in the ravines, where these steam mills are located, for the placing of this machinery for concentrating. Do you mean to extend that assertion to the Carson river?

A. The mills on the Carson?

Q. Yes, sir; with their locations?

A. No, sir; I have stated very particularly that they could use it as far as their fall went, and just in the same

manner. The fall is scarcely sufficient to accomplish the object, as I understand it.

Q. What fall is necessary for the successful working of ore by this process of concentration?

A. Well, it would require a hundred acres, at least, to make a commencement.

Q. A hundred acres?

A. I should judge so, for working the ores of the lode. It would not be a small amount.

Q. Suppose you worked a twentieth part of the ore at one place, how large a fall would you require there? How much fall for concentrating the ores, more or less?

A. Well, all that you can get would be desirable, with a graduated current. Too rapid a current or fall is not desirable, but a gradual fall is a very important item for working here.

Q. Ain't the fall along the river where the mills are now located just as great as the fall would be if the water were taken out under the mouth of the tunnel?

A. Yes; the united fall would be just as great, I suppose.

Q. What is the formation on each side of the river, at the point where it is proposed to build this dam?

A. I think it is trachyte rock, isn't it, Mr. Sutro?

Mr. SUTRO. Yes, I believe it is.

Mr. NEWCOMB. I won't state it as a positive thing.

Mr. SUNDERLAND. I expect that's right; I don't know. You stated the other evening that ore ought to be worked up to within ten per cent. of its assay value?

A. I think it is possible.

Q. I believe you stated here, Professor, on page 20 of the commissioners' report, that

"In the report of the Savage mine of this year we find that the loss in working from the assay value of the ores is, for gold $25\frac{1}{10}$ per cent.; for silver, $34\frac{2}{10}$ per cent. The larger the proportion of gold in the ore, the less absolute loss is made in the working. The above statement is the result of the workings in the Occidental mill, under the direct control of the Savage company, and includes all savings from slime and tailings secured to the company. In the Customs mills the report shows a less favorable result on the silver product, as follows: Gold loss, $23\frac{1}{10}$; silver loss, 44 per cent."

Where did you get that information from?

A. From the report of the superintendent, sir.

Q. I just want to show you that report now, and see whether you are not mistaken. This is the report of the Savage company for 1871, page 14. After giving the assay value of the ore by wagon samples, and the average yield of the ore reduced, the per cent. of the assay value, the report says:

"The percentage returned of gold and silver contained in ore is, gold, 75 per cent.; silver, $61\frac{9}{10}$ per cent."

Just look it over. I want your authority for it.

A. The saving of the silver is given at 56 per cent.; gold, $76\frac{9}{10}$ per cent.

Q. The average is $61\frac{9}{10}$.

A. The proportion of gold is greater than the proportion of silver in the reduction works. That is the percentage. The object of that was simply to show that there was more gold saved than there was of silver in proportion. Then it explains why it is so.

Q. Will you mention, as testimony, then, what months that is for? Just look at that table and mention the months.

A. September, October, November, December, January, and June. That is under the head of "detailed statement of expenses, etc., of the year ending June 30, 1871." Whether that was the entire result, or whether it was the result only of those months, I can't say.

Q. That yield is given at $61\frac{9}{10}$ on an average? Is that right?

A. I think that is correct, sir. I would state that the mill is required by contract to return (as I was informed by the miller) nearly 65 per cent. of the assay value of the ore; that is, taking the gold and silver.

Q. I haven't time now to look for the large amount of money paid for reclamation. I propose to read, Doctor, from Mr. King's report, page 241:

"The following statements, taken from the annual reports of the Savage Mining Company for the years ending July 1, 1868, and July 1, 1869, exhibiting some of the results of milling operations: The tables show the assay

value of the ore, both by the wagon samples and mill samples; the yield of the ore and the relation of yield to assay value; the proportion of gold and silver, both in the ore and in the bullion, and, finally, the total product in bullion of the quantity treated. The operations of each month are shown in the statements, but the figures of the tables for any single month represent the *average result* obtained during that month, not from *one*, but from *all* mills employed by the company in the reduction of its third-class ore. The second-class ore, treated in the last half of 1867, of which the results are also given, was all worked in one mill. It should be observed, concerning the comparatively lower percentage of value obtained from the second-class ore, as shown in the table, that, being richer, it resembles more in character the first-class ore, referred to in the commencement of this chapter, in which the precious metals are combined with zinc, lead, copper, antimony, &c., rendering the extraction of the gold and silver more difficult, and unfitting it for profitable treatment by the pan process."

Did you notice any of the base metals mentioned here in any of the ores there?

A. I did in some of them. I saw the ore that was delivered to the mill from the Savage company. I didn't see any in place.

Q. Will you state whether it is more expensive to reduce ores with any of the base metals mentioned here than it is free ore?

A. It depends upon the quantity of base metal. If there is a small quantity contained in it, it lessens the value.

Q. Well, suppose you have any considerable quantity of either lead, zinc, or antimony, can you reduce the ore by what is called the pan process without roasting?

A. Not well.

Q. Do you know whether, in roasting ores containing from $\frac{1}{3}$ to $\frac{1}{2}$ in value of gold, there is much greater loss of the gold than there is in the ordinary pan process?

A. On that point I cannot give you a satisfactory answer. I don't believe, if they secured all the gold, that there is a loss of any at all by the action of heat.

Q. If they secure it all. But suppose they don't?

A. Well, if it is done carelessly, they won't. If well done, they ought to secure the whole.

Q. By what means can you save all the gold in any ore after roasting?

A. I see no reason why you shouldn't save it all.

Q. Well, I want to know by what means you can secure all gold in roasting the ore?

A. I know of no reason why you should not, with your mercury, succeed in reducing equally well, after roasting, crushed rock.

Q. The loss is not in the amalgamation, but in the roasting.

A. What becomes of it?

Q. That is what I ask you.

A. Is it driven off?

Q. Yes, sir.

A. By heat?

Q. Yes, sir.

A. I don't believe a word of it. Gold has been kept melted for months in small particles without the loss of a single atom, and why there should be any evaporation here is a matter that I cannot account for.

Q. Then, your answer is that you don't believe there is any loss of gold in the roasting process?

A. I don't believe there is any loss from evaporation, or from being forced off by heat. There are a great many different opinions upon that subject.

Q. Well, I know from the reports that the percentage of saving of gold in the ordinary process is much greater than the saving of the silver. I know that in the process called the Freiberg, roasting in reverberatory furnaces, and also in the perpendicular furnace, the loss in gold is twice and three times what it is in the ordinary pan process.

A. It may be from some imperfection in the reduction, but as for driving off the gold with simple heat, almost every other substance will be driven off and leave that behind. I will state that you may melt that gold a thousand times without the loss of a particle of it.

Q. Is there no loss at the mints of the United States?

A. There is a percentage of loss, but not on account of evaporation. It is from handling. There is necessarily some of the gold sticking to the workmen's clothes, so that they take and burn them, and get back the metal in that way.

Q. How does that escape, if not in the melting?

A. It is in the process of handling. Fine particles of gold are worn off.

Q. Isn't gold found in the chimneys, or stacks, of all mills, and sometimes upon the roofs?

A. Well, it is in proof that that is the fact, but my opinion is that the gold went into a large vineyard, instead of in the chimneys, in stacks, and on the tops of houses.

Q. I read now from page 245 of the same work:

"The impression generally existing that only 65 per cent. of the value is obtained by the pan process, and that 35 per cent. is lost, is erroneous; for the return of 65 per cent. is based on the result in treating the ore in the pan, and collecting the amalgam in the settler; in some mills the additional product of the agitator is returned with that of the pan and settler, while in other mills this is not done, especially if the required standard of 65 per cent. has been already reached by pan and settle without further addition. Moreover, the return of 65 per cent. includes nothing of what is, or may be, obtained from the subsequent treatment of slimes and tailings; and, furthermore, it is to be considered that the ore, as charged to the account of the mill, contains an average of six or seven per cent. of moisture, for which, in the return, no allowance is made; the sample for assay, by which the return is made, being previously dried, 65 per cent. of the dry sample is really equivalent to 69 or 70 per cent. of the wet rock. This may be illustrated by the following data concerning the operations of the Savage mills during the six months ending December 31, 1867."

A. Let me ask you one question in connection with that: In taking the samples for assay, is the moisture retained, or does it go in as an element of computation when the assay is made?

Q. The ore that is sent to the mill is weighed with the moisture in it.

A. If the samples are taken moist to be assayed, carried to the mills so, and worked in connection therewith, I cannot see any reason for the introduction of an element of that kind.

Q. Very well, I will ask you about that indirectly. This is what Mr. King says:

"During that time 5,830 tons were worked. The average value of this ore was \$318,639 80 per mill samples, and \$324,206 72 per wagon samples; or \$54 51 per ton by mill sample, and \$55 61 per ton by wagon sample. The total of it obtained was \$220,785 17, equal to 69 $\frac{2}{10}$ per cent. by mill samples, and 68 $\frac{1}{10}$ per cent. by wagon samples."

Mr. SHOBER. What is meant there by "wagon samples?"

Mr. SUNDERLAND. When a wagon is ready, a man at the mines, employed for that purpose, if the ore is fine, has a

trier, such as you try lard with, and runs it in the wagon and takes it out. It is taken as a sample for the assay. The mill samples are always lower than the wagon samples, for the reason that no man taking samples for assay in a mine can select ore that is as low as the lower average. I never saw the man that could do it. I never could.

"This yield was obtained by the ordinary operation of crushing, amalgamating in the pan, and collecting the amalgam in the settler; this much constituting the process to which all ore is submitted in all mills. It will be observed that the required standard of 65 per cent. was already exceeded by this alone, without including the product of the tailings, or allowing anything for moisture. During the six months to which these figures relate, the product in bullion from the tailings was \$12,730 71; and if this be added to the yield of the ore originally obtained by the first operation, we have a total product of \$233,015 88, equal to 71.87 per cent. instead of 68.1 per cent., by wagon samples; or 72.12 per cent. instead of 69.2 per cent. by mill samples. If, in addition to this, we now allow for 7 per cent. of moisture on the ore, not taken into account in the assay sample to which the foregoing percentages are referred, we have an actual return of 77.27 per cent. by wagon samples, and 78.62 per cent. by mill samples.

"Finally, it is to be observed that the product from the tailings above given is not all that is obtained from that source. The amount here stated comes chiefly from the agitator. The stream of tailings passing from the settler, in which the bulk of amalgam is collected, enters the agitator, where much of the amalgam and quicksilver that has escaped the settler has further opportunity to deposit itself. At intervals of four or five days this vessel is emptied, and the accumulations are reworked in an ordinary pan, yielding \$18 or \$20 a ton. The yield thus obtained is nearly \$2,000 per month, and forms nearly, if not quite, all the product represented in the foregoing statement. After leaving the agitator the stream passes on, the tailings still carrying enough value to make them worth further treatment; for which purpose they are, in fact, sold by the mill to second parties, who do a profitable business in working them again; but this last product is not included in the figures already given. The yield obtained by this final working of tailings is not definitely known to the writer, but is generally stated at about \$5 50 per ton, which would add about ten per cent. more to the results of the process in the mill, as already shown. Some mills claim to have obtained more than 80 per cent., and even 88 per cent., of the assay value of the ore by the ordinary methods, without including the product of the tailings or allowing anything for moisture."

A. The item of moisture is contained in the working ore as well as the assay ore. Why he should bring it in as an element, I don't understand. It is weighed in the assay room.

Q. What is weighed?

A. The amount of ore that is taken for assay. And it contains the same amount of moisture as that in the wagon.

Q. Does a small quantity of ore, Doctor, thrown into a box, as you saw it there, exposed to the air, retain the

moisture as it does in a loaded wagon, or a large dump, where several hundred tons may be together at the same time?

A. The repeated handling of it in wagons gives it an opportunity to dry.

Q. What do you say as to the accuracy of Mr. King's report here?

A. Part of it I agree with.

Q. With what parts, and with what parts do you disagree?

A. Some portions of it I don't quite agree with: say where he designates the Comstock as a gash vein.

Q. I am speaking of that portion which I have read. I don't dispute your proposition that the Comstock is a fissure vein at all; I never did dispute it. I always believed it.

A. Well, as far as that is concerned, I cannot say. He has gone into a computation there that may be correct or not. I will not pretend but what it is correct.

Q. Do you know where Winfield mill is situated?

A. No; I don't recollect.

Q. It is north of Virginia, in a cañon; there are three mills close together. It is called Seven Mile cañon. Now, I will ask you if below that and above the mouth of the cañon there are not dams to save all the tailings that have not been previously concentrated?

A. There are a great many places where the tailings are caught for the mills. There are mills especially for working the tailings, and in some cases they are quite successful. These tailings are worked over and over again in some cases, and with about the same result each time, or until they get clear down on to Carson valley, and there they get it again. I saw immense bodies of tailings down the valley and near the river, and there they are being worked again. If you take the tailings from that by assay, you get a large amount of ore.

Q. Are not the appliances there now, Doctor, down that cañon and about the Carson river, for the saving of tailings,

about as complete as you could make anything at the mouth of the tunnel?

A. No, sir; I don't think so.

Q. What escapes now that is of sufficient value to be worked, and where does it escape to?

A. It is not an uncommon thing during the freshets, you are aware, for the whole amount of the tailings to be swept off into the Carson river. That is one of the elements of loss.

Q. Have you ever seen it?

A. No. But the inhabitants there told me that that is a fact; those that are working the tailings say the same thing.

Q. Did you see large bodies below the Gould and Curry mill?

A. Yes.

Q. Were you not informed that those were part of the tailings saved from the Gould and Curry mill immediately after the mill started?

A. This was a case where the wash alone swept it away, and they have some few positions of that character. But I saw many of the tailings in positions where they would be carried off and lost.

Q. Do you know anything about any tailings mills at the Dayton?

A. Yes, there is a very extensive mill there—the Bird-sall mill.

Q. What capacity has that mill?

A. I don't know. It is a very large building. I didn't go inside of it.

Q. Did you hear any statement?

A. I heard a statement that they were saving from tailings \$50,000 or \$60,000 a month. That was the yield of it. That was the representation made.

Q. Are there any tailings escaping from the reservoir there? Did you see any? They have got a large reservoir there, have they not?

A. They have got immense embankments.

Q. Enough to last a great many years, ain't there?

A. It depends upon how rapidly it is worked, of course.

Q. Well, I don't know whether they are working their mill up to its full capacity. It has a capacity of 400 tons a day.

A. I know; it is a very extensive concern.

Q. Now, you have expressed an opinion that the owners of mills on the Carson river would be very foolish if, when the tunnel is completed, they don't remove their mills to its mouth?

A. Is that the expression?

Q. Well, that is what I have got it down.

A. I will state it. It would be very greatly to the interests of the owners of the mills upon the Carson river to relinquish their water powers and transfer their mills to the mouth of the tunnel, if they could have, without charge, the use of the water of the Carson as they have now, and at the same time have the additional facilities granted, without the expense of supporting hands. I think that men will be actuated by their interests, and they might be induced to make the change, if it could be made without cost.

Q. Who is going to build and repair this dam?

A. The Sutro tunnel is bound to do it.

Q. How are they bound? Where do you get that from?

A. They will be bound by the contract that they would enter into with the mill-owners.

Q. Where is that contract, Doctor? I would like to have you refer me to it?

Q. Show me the bargain, and I will show you the contract.

Q. Your expression the other evening was that the miners would be very foolish, etc. I recollect the expression, for I took it down at the time. You talk about mill-owners getting mill rights and mills down there for nothing. The Sutro Tunnel Company, as I understand you, builds this dam and furnishes water there free of charge—mill rights?

A. Mill sites in exchange for the mill sites they have now.

Q. Where did you get the idea from that the Sutro Tunnel Company is going to do anything of that kind?

A. I think the constructing of the dam and the necessity of receiving the titles of those who own the water power.

Q. Didn't you get that idea from Mr. Sutro?

A. No, sir; I did not. The most I have heard Mr. Sutro say about it was, that he could secure it. He didn't say how.

Q. Mr. Sutro, in a pamphlet issued in 1866, estimates the value of the grant of land at the mouth of the tunnel for mill sites and town lots at \$3,000,000. Does that look like giving us mill sites there free?

A. If he gets any equivalent return for it, yes.

Q. What do you call an equivalent?

A. By their giving up this water power in exchange for the power at the mouth of the tunnel.

Q. Then we abandon all our mills, to commence with, for nothing?

A. I didn't state that. Abandoning and transferring are two separate and distinct things.

Q. Then, if it is giving value for value, it isn't getting the water power and mill sites for nothing at the mouth of the tunnel, is it?

A. Certainly it is.

Q. If you give property that is worth \$6,000,000, as he states there, for our mill sites and water power, it is getting it for nothing?

A. Does that take up the whole of the ground?

Mr. SUTRO. Why, Mr. Sunderland, that means that there is a town to be built at the mouth of the tunnel.

Mr. NEWCOMB. It don't matter anything about the town. I stated that if they could have a mill site and a mill upon the place, and could be relieved from the risk of the dam being carried away by freshets, and keeping in repair, they would be acting against their own interests decidedly if

they were not willing to make the transfer. I would make the transfer.

Mr. SUTRO. Will you allow me to state right here, that within the last sixty days a number of those dams have been carried off by a freshet?

Mr. SUNDERLAND. So far as I am concerned, I don't want to be interrupted. When you express, Doctor, that you, as owner of a mill on the Carson river, would freely accept the proposition to remove that mill to the mouth of the tunnel, does that authorize the opinion, that the owners of the mills upon the Carson would be very foolish not to do it?

Mr. NEWCOMB. Well, if you take the expression of "very foolish," I should say yes; that men would be acting very foolish not to accept it, because they would be operating against their own interests. If you want it in that form I will give it so, because I believe it would be for their interests to accept.

Q. Don't you think the owners of mills and mill rights upon the Carson river have a right to determine for themselves, without any advice from anybody else, as to what they will do with their mills and their mill rights?

A. I haven't questioned that right at all, sir.

Q. I read now from page 23 of this pamphlet of Mr. Sutro, published in 1866:

"The mills, which are at present scattered in a circuit of fifteen miles around the mines, and have cost from \$5,000,000 to \$6,000,000 in their erection, will all have to be removed to the mouth of the tunnel. At that place they will have to pay nothing for transportation, since the ore, without rehandling, may be dropped from the cars which bring it out of the tunnel right in front of the stamps. Mills situated at a distance could not reduce ore at the same price, after paying several dollars a ton for transportation; and, consequently, could not compete with those at the mouth of the tunnel. The only recourse left to them is to remove to the tunnel company's land."

Mr. SUTRO. Mr. Sunderland, that is a statement published to show the value of the rights connected with this tunnel enterprise, in order to induce capital to enter it.

Mr. SUNDERLAND. I understand it. Part of the value of that land was the sale of mill rights to different mill companies or owners of mills. If Mr. King be correct in

saying that from 80 to 88 per cent. of the assay value of the ores is saved by the different processes used, which I have read, do you think that the loss of the metal now is so great a disgrace to the country as you expressed the other evening?

A. If 88 per cent. is saved, it isn't as great a disgrace as though 35 per cent. is lost.

Q. Do you think that 35 per cent. is lost, Doctor?

A. I don't know about the full amount, because a portion of it is picked up; but I think that the amount saved is not over 5 per cent. It is my opinion that the loss is not over 30 per cent.

Q. Mr. King says in this connection:

"The following table shows some of the comparative results of a number of different mills, all working on Savage ore, at sundry times between July 1, 1867, and March 1, 1868. The statement is furnished from the records in the office of the Savage Mining Company. The careful manner in which Mr. Bonner, the superintendent of this company, and his assistant officials, have collected and preserved, in comprehensive form, the various results of milling and mining experience, is worthy of high praise and extended imitation among others similarly engaged."

I will ask you if, while you were there, you asked to have access to any of the books of any company, to ascertain what they did save and what they lost?

A. We asked the superintendents and the mill-owners, and they said that the amount of the yield was required to be 65 per cent. They stated that in some cases they received even a larger percentage than that. They were entitled to the excess of the working of the ore, but the general return, as represented by some of the parties, was, that they got the 65 per cent. and no more. The miner made that. With reference to the slime and the tailings, why they were either taken up by the mill and reworked, or by other parties, to a greater or less extent.

Q. Well, the tailings and the slime, Doctor, belong to the mill, do they not?

A. It is stated so there. But the moment it passes off of the boundary of a mill company, washed down, it ceases to belong to the mill.

Q. Well, it is caught by somebody, isn't it? Is there not

somebody all along the ravines and cañons there catching these tailings?

A. Yes.

Q. Now, then, if the process that Mr. King describes here yields from 80 to 88 per cent. of the metal in the ores, and the mine or the mining company gets 65 per cent. alone, what difference does it make to the Government, or to any man who is not a stockholder in the mining company, whether the mine gets it or the mill?

A. It makes no difference to the Government, that I am aware of, if the bullion is obtained.

Q. Does it make any difference to Mr. Sutro or the Sutro Tunnel Company, who don't own any stock in any mine on the Comstock?

A. I am not so sure about the correctness of your statement. I have reason to think otherwise.

Q. I have no doubt you know from Mr. Sutro. I am not in the confidence of Mr. Sutro at all.

A. I don't know from Mr. Sutro. I don't know that Mr. Sutro owns any stock, but I know that several wealthy men in the company own heavily in mining stock. I don't know that the Sutro company owns stock as a company; but I know that individuals of the company own large mining stocks.

Q. I believe you stated the other night that the cost of the reduction of ore varied from \$11 to \$13 on the ton of ore?

A. It was represented so to us. That included the transportation.

Q. You read this report of the Savage company, I believe, did you not? That is, you had access to it when you were there?

A. Yes, sir.

Q. I read now from page 9 of the report of the superintendent of the Savage company to the stockholders:

"The average yield of the ore reduced is \$21 43 per ton. The average cost of production, which includes labor, materials, and all incidental expenses, is \$11 06, and the average cost of reduction is \$9 95 per ton; leaving a profit of 42 cents per ton."

A. I would ask, in connection with that, if they do not have one of their own mills, at which a pretty large portion of their ore is reduced?

Q. Well, I will answer that. I didn't expect to call attention to that. I will answer it by the report of the superintendent:

"A small portion of the ore has been reduced at the company's mills at Washoe. It has been running but six months out of the twelve. The Savage mill can be run at some profit during the summer months, but it is questionable whether a profit can be shown for the whole year, on account of the necessity of retaining watchmen and paying insurance on half of the year, while it is idle."

That is the answer. I read now from page 14:

"Average cost of reduction, \$9 95."

A. What is the cost of transportation to the Washoe mill?

Q. That includes the transportation always. There is no mill (as you were probably informed while you were there) that don't undertake to reduce ore for so much a ton, including the transportation. I will venture to say that you didn't hear of anything else.

A. Yes; but this was not a customs mill. The Washoe mill belongs to that company.

Q. I was aware of that?

A. Whether the transportation is included in that cost of reduction I didn't know.

Q. I will get you to look at that table in this report, and first state the cost of reduction of ore. You will find everywhere, in every report that has been made, (I have got all 70 of them,) that the cost of reduction includes the cost of transportation, from the year 1867 down to the year 1871.

A. Do you want the total cost or the cost of reduction?

Mr. SUTRO. What page is that on?

Mr. SUNDERLAND. Page 14.

Mr. SUTRO. Year 1871?

Mr. SUNDERLAND. Yes, sir.

Mr. NEWCOMB. In 1867 the report gives here \$14 04; 1868, \$13 74; 1869, \$12 22; 1870, \$10 01; 1871, \$9 95. That last is the latest report given here.

Mr. SUNDERLAND. I simply introduce that to show the gradual reduction of the price of reduction of ores.

Mr. SUTRO. Won't you read the next table of the cost of production, to see how that runs?

Mr. SUNDERLAND. I don't propose to introduce that. I propose now to read from the 238th page of Mr. King's report:

"This price of working ores during two or three years past has varied between \$13 and \$15 per ton, including the cost of hauling the ore from the mine to the mill. Quite lately it has been reduced somewhat, though during 1869 the average was but little, if at all, below \$13. Since the beginning of the present year, according to late advices from Virginia City, some of the mills of the district have reduced the price to \$9 per ton."

Mr. NEWCOMB. There was no working for \$9 that I was aware of when there. The man who was running on Savage ore made the statement, that the amount paid was \$11, and that it was the cheapest of any. When carried by railroad they exacted \$13.

Q. Did he run any mill that was supplied by railroad?

A. His was supplied by wagon.

Q. I would like to know his name.

Mr. SUTRO. Going to knock his head off?

Mr. SUNDERLAND. No, sir. It ain't true; that is all.

Mr. NEWCOMB. It's the Occidental mill.

Mr. SUNDERLAND. They charge \$11, do they?

A. They charge \$11 per ton, taking the ore from the dump of the mine. It costs the mill \$1 per ton for cartage.

Q. Does he say how much for reduction at the mill?

A. He says \$11, including \$1 for carting.

Q. What does he say it costs the mill company to reduce the ore at the mill?

A. He don't state. He stated the amount of quicksilver to a charge, and the loss of quicksilver, and the cost of quicksilver.

Q. Just state that, won't you, please? What is the loss per ton?

A. He puts in a charge of 200 pounds of quicksilver

with $1\frac{3}{4}$ tons of ore, and the actual loss of the quicksilver is $1\frac{1}{2}$ pounds to the ton.

Q. What does the quicksilver cost per pound?

A. 80 cents, delivered.

Q. Could you reduce the ores at the mouth of the tunnel with a less amount of quicksilver?

A. No, I suppose not. I suppose it would take the same amount.

Q. The loss of quicksilver would be the same?

A. There is a possibility of its being greater, because the more it is moved or worked, the greater the loss by oxidation.

Q. Doctor, the advantages you mentioned the other night of moving Virginia City and Gold Hill, or the inhabitants of those places, to the mouth of the tunnel——

A. I haven't proposed any such thing, sir.

Q. Did you not state, in answer to Mr. Sutro, that for the miners to live at the mouth of the tunnel would be of advantage to them on account of the great healthfulness of the place?

A. Yes; but that is an entirely different proposition, on account of its being convenient to raise vegetables and keep cows.

Q. And the great healthfulness of the locality?

A. Yes; but that doesn't remove Gold Hill and Virginia City.

Q. What would be left of Gold Hill and Virginia City if the mines were not worked through the shafts, and all the miners lived at the mouth of the tunnel?

A. It would take a pretty large population away undoubtedly.

Q. What would there be left there? What business or what object would there be for anybody to remain there?

A. That is for the citizens to decide.

Q. Well, what I wanted to get at specially was as to its being more healthy than it is at Virginia City?

A. The elevated region of Virginia City is very likely to affect the mucous membranes seriously. Some that were af-

feeted with asthma were benefited, on the other hand. The climate is somewhat different; it is warmer at the mouth of the tunnel. The winds are less there, as I was informed, and as far as I saw. There are less transitions of temperature.

Q. Are not the extremes of heat and cold on the Carson river greater than they are at Virginia City?

A. There is greater heat; I think not so great cold. At the same time I cannot say; I haven't made a register?

Q. Do you know whether or not it is healthy along the Carson river?

A. They say that Dayton is much more healthy than Virginia City.

Q. Do you know whether there is fever and ague along the river?

A. I didn't see anything of it while I was there. There may be.

Q. Do you know or not whether, while you were there, the men engaged in repairs upon the Franklin mill were all taken sick, and work had to be suspended according to the sickness there?

A. I didn't hear anything about it.

Q. Were you at the Franklin mill?

A. I don't recollect of hearing any such remarks. I think I was at the Franklin mill.

Q. Is it at or near this Franklin mill where they propose to build this new dam?

A. It isn't far from the railroad.

Q. No, it is right above Dayton. It's the second mill above the Birdsall. There is the Ophir or Woodworth mill and the Franklin mill.

A. Whose mill is that?

Q. It belongs to the Union Mill Company.

A. I think we were at that, and one that was working for tailings.

Q. Then you know nothing about any sickness there at all?

A. I heard nothing about it while I was there.

Q. I believe you said the miners, so far as you saw them, appeared to be healthy, both at Virginia City and Gold Hill, did you not?

A. They claimed to be healthy. I asked them how they liked it in the mines, and they said they liked it better there than they did above; they preferred working there to working above.

Q. You didn't see any great distress among the miners, did you?

A. Occasionally.

Q. In and under what conditions did you see any distress among them—a little too much whiskey? They got too much money, I guess, or they wouldn't have drank so much. You found one mine very hot; which was it?

A. The Yellow Jacket was the hottest.

Q. On what level?

A. I think it was the 1,100-foot level. I am not sure.

Q. That was north of the shaft?

A. When you get down, except by the compass, you can hardly tell which way you travel.

Q. Did you go to the end of the tunnel on that level, Doctor?

A. He took us through, I think, very generally, and showed us the mine very kindly, and showed us the hottest place in the mine.

Q. There was nobody at work, was there, in that hottest place?

A. No; they were at work in the neighborhood. I will mention, in connection with this, that at the headings, where the blowers were playing, it was comparatively comfortable. The atmosphere was comfortable, and they were able to work. Although they were dripping with perspiration, they didn't stop.

Q. That is what I want to get at. Now, it is below that point, where the blowers are in operation, and where nobody is at work, that the extreme heat exists?

A. The drift that we found the hottest point in led off to one side.

Q. There was nobody at work there ?

A. Not while we were there.

Q. If they were at work, wouldn't it be just as easy to turn the pipe in there and discharge the air as at the heading, where the men were at work ?

A. No doubt of that.

Q. Well, that was done while men were at work there. That was where you saw the thermometer at 103° ?

A. I didn't see it so.

Q. I think you mentioned it ?

A. No. General Wright stated it, and the superintendent stated it, I think. The highest I registered was 97° .

Q. Was there anybody at work where it was at 97° ?

A. Well, they were passing back and forth there. There was nobody at work.

Q. I understood you to say the other evening that the 1,000-foot level was where the thermometer stood at 103° . The heat would increase at the rate of 1 degree to every 40 feet.

A. No; I didn't state so. The increase from the 1,000-foot level down will be an increase of 1 degree, I think, in 50 feet, until you get to the 2,000-foot level, when the increase would be very much greater in proportion.

Q. Then for every 40 feet below the 2,000-foot level the heat will increase 1 degree ?

A. Probably as much as that; and yet we cannot determine. They vary in different mines.

Q. Well, ain't there a rule established for the increase of heat in different depths ?

A. Observations have established a sort of a rule, that varies in different localities. It ranges from 55 feet to 60 feet in our latitude.

Q. Why should the increase be greater on the Comstock than anywhere else ?

A. You are assuming again.

Q. You say that in this country it is from 55 to 60 feet descent for every degree ?

A. That is, down to a certain point; and I have explained

that, when you get below that point, the ratio of increase is greater. It is so in other countries, and, so far as observation goes, it is so in this. There is the report of the mining engineers of England, that at the depth of 4,000 feet the heat would be so increased that we cannot work below it.

Q. I understood you to say the other evening, that at the depth of 2,000 feet the thermometer would stand at 123° ?

A. Yes, sir. That is, figuring it at an increase of one degree in 50 feet.

Q. Now, I understand you to say that, with good air, the working capacity of the men will be increased 25 per cent.?

A. Yes, sir.

Q. How many men did you see working in the Comstock in an atmosphere that was either debilitating, unhealthy, or unpleasant?

A. I saw them in this very mine that I have been speaking of, the Yellow Jacket, stripped, and with the perspiration reeking from their bodies. I don't pretend to say in regard to the healthiness, because the men pronounced themselves healthy.

Q. Do you mean to say that, in the Yellow Jacket, if the air was better, the mining capacity of the men would be increased 25 per cent.?

A. I don't say that. By the aid of artificial ventilation, it would be increased very much beyond that amount; and it would be still further increased if the ventilation could be increased.

Q. Did you see men working anywhere in the Yellow Jacket where there was not good air?

A. From the position that I occupied, the air was suffocating. The men were not at work at that point.

Q. At any place where the men were at work in the mine?

A. At the headings it was comparatively comfortable.

Q. Where you saw the men working in the Yellow

Jacket, was their working capacity 25 per cent. lower than it would have been upon the surface, or anywhere where they could have had the freshest air?

A. No, I think not; but if they go down another—

Q. Well, I am talking about what you saw there. Did you see anybody working anywhere on the Comstock, where the heat was so great as to reduce their working capacity 25 per cent.?

A. I saw men who said the heat was very great, but they could stand it. I inquired of a number of these men how they liked it, and they said they liked it very well, and passed by it without any further remark.

Q. Did you state the same evening that, where these men were at work, you found it very comfortable for yourselves?

A. Yes, sir; we got the full benefit of the blowers. It was quite comfortable, especially after being subjected to this intense heat that we met.

Q. Did you take the degree of heat at the headings where the men were at work, and if so, how high did you see the thermometer where the men were actually at work?

A. Well, I don't recollect. I think something over 80°.

Q. I think you stated 80° or 85° the other evening.

A. Where they get the full current of air upon them it is very refreshing.

Q. Well, one of the advantages of this tunnel is claimed to be ventilation. Would it improve the ventilation of the Sierra Nevada or Chollar Potosi?

A. They don't need any improvement where they are working at the present time. It would improve the Chollar, by forming communication with the lower levels.

Q. Where they are working at present, could the ventilation be increased at all in the Chollar or the Sierra Nevada?

A. They could build a shed over the Sierra Nevada.

Q. I understood you to state that the blowers would not be sufficient to ventilate the mines below the 2,000 feet. Was that so?

A. That is my opinion.

Q. Why not?

A. Well, you would need compressed air thrown in.

Q. How much more power does it take to send a quantity of air down 2,000 than 1,000 feet? What loss is there in power or in the air?

A. There is considerable loss, but how much I cannot decide. Your patent blowers operate, perhaps, somewhat differently than others, and it would be necessary to make a test of them, in order to determine with accuracy.

Q. Then it is a mere matter of opinion with you?

A. Yes, sir.

Q. Did you ever see blowers used anywhere, except in the Comstock, for ventilation?

A. Yes, sir, in a good many places.

Q. How deep have you ever seen them used?

A. Oh, some hundreds of feet; but never yet as deep as in the Comstock.

Q. Didn't they operate as well at the deepest levels on the Comstock as they did on the higher levels?

A. Yes; but, as far as that was concerned, there was no comparison to be made, because on the upper levels they needed none; the rock had been cooled off. If you want my opinion in regard to it altogether, I believe every appliance that can be brought to bear will be required below the 2,000 feet—blowers, circulating mediums, communicating shafts, and everything of that description.

Q. What facility will the construction of the tunnel give that cannot be had now for ventilation?

A. If you use the same amount, it will be an increase of it. Use the amount of power to ventilate now, this will be additional.

Q. Will it dispense with the present means used for working the mines?

A. It will not dispense, in my opinion, with mechanical appliances for cooling the mines. It will aid, but that is all. It is an adjunct, but not sufficient of itself.

Q. You know, Doctor, that when a level is worked out, it is timbered up and filled in with refuse?

A. Yes.

Q. After the whole level is worked out and filled up in that way, is it possible to ventilate it, or would it be any object to ventilate it?

A. No; there is no further use for it, after it is closed up. It becomes like the original rock, as far as ventilation is concerned. There is no necessity for it.

Q. It has been claimed here that timbers would stand, I believe, for 30 years in a mine, if it were well ventilated. Is it possible to ventilate a level after it has been filled up in that manner, so as to preserve the timbers?

A. After it is filled up, no; but your passageways, which are timbered, require ventilation. They have to be preserved.

Q. Why so? Why preserve them after the level is worked out?

A. For communication with the different parts of the mine.

Q. Why do you want communication with different parts of the mine after you have worked it out? Why do you keep any open space after you have worked out every level?

A. In the first place, we are not aware that every level has been worked out. We want it for further prospecting.

Q. Would the tunnel assist in the further prospecting of one of these levels?

A. Not the upper levels; no.

Q. On the subject of stock-jobbing, I believe you stated the other evening that it had been the practice, when a bonanza of ore was found, to gouge it out and put up the stock, and then sell out.

A. Mr. Sutro made a statement, and I, to a limited extent, accepted it.

Q. I first wanted you to explain to the committee what is a bonanza?

A. It is a Spanish word, signifying a body of paying ore.

Q. Then you don't affirm that stock-jobbing has been the practice, Doctor?

A. Oh, I know that there is stock-jobbing continually, and that the parties who are considered as being in the ring have the advantage of all outsiders.

Q. What ring do you speak of?

A. Well, it is designated in California and in Virginia City as "the mining ring."

Q. Are there not a good many rings spoken of there?

A. I didn't know of a great many.

Q. Ain't there more than one mining ring?

A. I don't know but one, and I don't know that excepting from report.

Q. You stated (I don't think I am misstating) that when a bonanza was struck the mines were worked for legitimate purposes, but that when there was no ore in the mines they were worked in San Francisco. What authority have you for saying that, Doctor?

A. It is a self-evident fact. The report of the stock board will be sufficient to establish it.

Q. Do you think that the running of the tunnel would prevent a mine being worked in San Francisco?

A. No, sir; unless it thoroughly laid the lode open to view. In that case the value of the stock could be determined, approximately at least, and the buyer and seller would be placed upon terms of equality. They would understand the business transactions, instead of making it a gambling speculation, as much of it is now.

Q. Is there any reason why the branch tunnel, which would be run from the north to the south end of the lode on one level alone, should expose the bodies of ore, and lay them open as you speak of, any more than now?

A. It would expose the lode very much better and at very much less expense.

Q. Explain how it will expose it?

A. Simply by passing along your tunnel, and running in a drift every hundred feet from that tunnel.

Q. Who is going to run these drifts?

A. I suppose the mining companies, if they want to determine the value of their ore.

Q. Suppose they don't want to?

A. Of course, then, they are not obliged to do it.

Q. Suppose they want to work their mines in San Francisco, as you speak of?

A. Well, they will probably do it.

Q. Then what frauds in San Francisco would this tunnel prevent?

A. Those who have facilities for making investigations are likely to improve them, and it would open the ore-bed at a depth of 2,000 feet through the whole extent of the lode where the transverse tunnel is run.

Q. In all the mines you were in, are not drifts run and cross-cuts made in prospecting and developing ore?

A. I don't know but there are hundreds of miles of drifts in all.

Q. Ain't everything exposed there to the view of everybody, so far as you know?

A. So far as I was concerned, I had the privilege of all that I could see in visiting the mines.

Q. Did you ask to see anything that you didn't?

A. Well, that's a little bit of a question. We were to have visited one or two mines that we did not. I put the construction upon it that it was an accidental omission on the part of the superintendents. Whether it was intentional I don't know. The Savage and the Hale and Norcross are the two to which I refer.

Q. Captain Fair told me at one time that he wasn't prepared to receive you, and at another time he told me to tell you that he was prepared, and that he had informed General Foster?

A. I didn't receive the word.

HEARING TUESDAY MORNING, FEBRUARY 27TH.

Mr. SUNDERLAND, (continuing cross-examination of Professor Newcomb.) Professor, I believe we closed last night on the subject of stock-jobbing. You had before stated that the construction of the tunnel would tend to consolidate the mines or the mining companies. Ain't the consolidation and control of the Comstock now, mostly by one company, what is most complained of? It is the cry of monopoly, ain't it? Ain't that the great objection to the present mode?

A. I don't know where the monopoly comes in quite as to the ownership of the mines, because there were a great many different mines ruled by different bodies of trustees or superintendents: they may be influenced possibly by a particular interest.

Q. Would you think it desirable to have the Sutro tunnel and the entire Comstock consolidated into one company, and controlled by a single corporation or a single set of men?

A. It is my opinion that the Sutro tunnel should be owned by the mining companies, instead of their being separate companies, in order to make the matter perfectly satisfactory. I think the Mexican rule in regard to that was a good one.

Q. What was that, Doctor?

A. It was that, in cases of running tunnels for the general benefit, it is better for the mines to own the tunnel, than for the tunnel to be held by a separate and distinct company.

Q. There was no rule in Mexico authorizing the running of a tunnel by a party who did not own the mines, and then compelling the mines to pay royalty for it?

A. No, it was supposed they would know enough for their own interests to run the tunnel and operate through it.

Q. The owners of the mines?

A. The owners of the mines, I think, would be benefited by owning the tunnel or owning an interest in it.

Q. The owners of the mines in Mexico, then, were permitted to run a tunnel or not, as they chose: there is no rule compelling them to run a tunnel, is there?

A. No.

Q. Or to pay royalty to any one else that did?

A. None, except that of self-interest.

Q. Don't you think in the working of mines, as in any other business, it is best to let the owners of mines work as they think best?

A. Not where they are working wastefully, I think not; because we are entitled in our country to the greatest results that can be produced from the mining interest. Every man has an interest in it.

Q. Suppose an iron mine in Pennsylvania could not be worked according to your standard, what would you think of Congress interfering to have that mine worked in some other manner.

A. I should think that in the case of an iron mine the circumstances would be entirely different. The right of eminent domain belongs to the Government of the United States, and these mines are presented to them, where they take out their patents, for a nominal sum, and for the purpose of being worked, and worked judiciously. The bullion that is taken out goes into the circulation of the country, enriching the country in proportion to the amount of the product. In that respect it becomes a national affair. With reference to the iron mines, they are particularly individual property, that the Government does not interfere with. They are not sold, as mineral lands are sold, when the precious metals are concerned. The distinction, I think, is a very clear one.

Q. Will you give me the difference between the wealth added to the nation by the extraction of \$20,000,000 of bullion, and the extraction of \$20,000,000 of iron from an iron mine?

A. There is a distinction that is drawn between them. The results to individuals would be the same. It may be greater in the case of the iron product, because it is a matter of mechanical necessity, whereas the bullion is quite another thing. In another respect the bullion increase would be more important to the general interest, because it forms the basis of value as a circulating medium. In the one case they hold their property on sufferance; in the other case, they own the right entirely, as I understand the mining laws of the country.

Q. You state that the mines, the gold and silver mines, are sold by the Government for a nominal sum?

A. Subject to certain conditions.

Q. What are these conditions?

A. Well, one condition that is made in the patents that have been granted, subject to the Sutro tunnel act, is, that whenever they shall strike the lode, the mining companies shall pay a royalty upon every ton of ore extracted and carried out through the tunnel. Another condition in connection with it is, that an exclusive right has been granted to the Sutro Tunnel Company, by the State of Nevada, to run from the plains of the Carson a drainage tunnel—for the purpose of working, or ventilating, or draining, or other purposes—from the Carson Valley to the mines, having the exclusive right for a term of years.

Q. What authority did the State of Nevada have for authorizing that tunnel? What interest in the soil, or what rights to the public lands did the State of Nevada have, that it could give to Mr. Sutro such privileges?

A. The State of Nevada, as the State of New York, or Virginia, has the right of regulating matters of that description, just as they would have of making a mining law for the benefit of the miners.

Q. The State has the power of regulating some things, but it has not the power to give away that which it has not. The State of Nevada never had any right to the public lands, the title being with the United States the same as the mines, and I ask you what power—

Mr. SUTRO. I object to that question. There is such a law on the statute-book, authorizing the construction of a tunnel, and giving exclusive right to construct that tunnel. The Doctor is not here as an expert in law.

Mr. KENDALL. Do you see any similarity between the policy of the Government in preventing waste of precious metals and the policy of the Government in preventing waste of timber upon the public lands?

Mr. NEWCOMB. I think there is a correspondence between the two. I think it is right that this property should not really belong altogether to the companies who have it, to do with it as they please. They have no moral right, although they may have a legal right, to leave the treasures there when the necessities of the Government require their development.

Mr. SUNDERLAND. How many silver mines are there on the western coast?

A. Those that have been entered as silver mines are countless.

Q. Is the number of gold mines nearly as great?

A. The gold mining is very extensive as well as the silver mining.

Q. Has the Government, in any instance, undertaken to regulate the working of any of these mines on the entire coast from the Rocky mountains to the Pacific ocean?

A. I am not aware that there is any law upon the subject, excepting that they have the right to make the purchase of their mineral lands under act of Congress. They have been thrown into the market—the gold mines as well as others. I think there is a law of that description that has been enacted within a few years past; formerly the idea was founded upon Senator Benton's statement, that he wished it would be worked out as rapidly as possible, and thrown open to the community—the placer diggings. It was operated upon that principle, and a law was enacted granting the privilege of purchasing mineral lands.

Q. Now, then, you state, in answer to Mr. Kendall, that you saw no difference between protecting the loss of metal

in a mine and the loss of timber upon the public lands. Is there any law for the protection of timber upon lands after a pre-emptor has gone upon the lands—before he attains the title?

Mr. SUTRO. I object to that, Mr. Sunderland. The Doctor is not here as an expert, to expound the laws of the United States.

Mr. SESSIONS. Well, he can answer and go right along.

Mr. NEWCOMB. I don't know what the law is upon that subject of the pre-emptor going on. I know there is a law made for the protection of timber upon the public lands.

Mr. SUNDERLAND. For timber upon lands belonging to the United States, and unoccupied by individuals, is it not?

A. I should suppose so.

Q. Now, these mines are all under occupancy by somebody, are they not? They must be possessed by somebody.

A. Yes, they are.

Q. Well, now, do you see any similarity between the case of a mine that is being worked, and therefore in the possession of somebody, and the case of public lands not in possession of anybody, and where no one has made application to pre-empt that land?

A. I suppose application could be made by the parties that are trespassing upon the public lands, precisely in the way that I have mentioned in the Crown Point. Since I was there they may have obtained a patent. When I was there they had not done so; it was the property of the United States. They were just as much trespassers upon the land technically as a man cutting public timbers would be, without the privilege of the Government. That is the view that I take of it, at all events. I advised the superintendent, at the time, to get his patent as soon as he could. Whether he has done so or not I don't know.

Q. I suppose, likely, he thought that he would determine he would take it, did he not?

A. I suppose so; he had a right to determine that mat-

ter for himself, and to risk the title to his property if he chose.

Q. Did he tell you why he didn't take it?

A. Oh, he said he did not think it was worth while just then.

Q. Didn't he tell you it was because of the condition of the Sutro tunnel project that he did not take out his patent?

A. I don't recollect that he did. We were not referring to the Sutro tunnel at the time the conversation occurred.

Q. Do you know other companies that have refused to take their patents on that account?

A. I don't know of any besides that. I don't recollect of any others.

Q. I think you said there were some 40 companies now at work on the Comstock?

A. I did not state how many. I don't know the number. I cannot tell without counting them up. The number may be 40 or 50, or only 30.

Q. Don't you think it is better to have a number of companies at work on that Comstock than to have the work all in the hands of a single party, or a single corporation, who would then control everything? Don't you think it is better for the people that it should be so?

A. Well, a good deal can be said upon both sides of that question. In the first place, if worked economically, an immense corporation would produce an immense amount of wealth to the individuals of the corporation. If divided into numerous corporations, there would not be that concert of action, that system of reduction, that would result from one management. With numerous companies it would not be so economical; the expenses would be greatly increased over those of a single company, owing to the multiplicity of officers.

Q. Would not the ownership of the entire Comstock create a power which would be dangerous to the welfare of the people of that section of the State, and to the State

itself. Wouldn't it aggregate more than half of the wealth of the State?

A. I should say that you put the matter a little low in regard to the aggregate. I conceive the wealth of that lode to be the chief wealth of the whole State. That, with the other mining interests, would be about all the wealth there is in Nevada, although there is some little agriculture.

Q. Do you think it would be safe to create a corporation with such power in any State?

A. We have such powers created in the East, that wield a great deal of political influence; we have the extension of railroads, and the tendency to reunite them for the accommodation of the public, but mainly for the benefit of the individuals that run the roads; we have grand trunks extending north and south. Take the concentration of the New Jersey roads, and the Erie road in its connections, its branches, and the same thing holds good. Wherever you go, if men can work more economically for the benefit of the public in general, why it is an advantage to them, although dangerous in the power that they may wield or exert in the community politically.

Q. Well, I understood you to say that you thought the completion of this tunnel would stimulate exploration and prospecting. Do you mean in the Comstock?

A. I mean in the Comstock as well as in the lateral lodes that are running nearly parallel with it.

Q. Do you know of more than one lode which that tunnel would cross before it would get to the Comstock?

A. According to the map on which it is laid down, and the more careful survey that I examined in the connection which is mentioned in the report of Baron Richtofen, there are others on the track. I could trace only two, although three are laid down.

Q. It is an easy matter to make a thing on a map, but it is not so easy to find it on the ground?

A. I traced the track of the tunnel in connection with the geological report of the Baron's.

Q. Did you see more than one lode there?

A. I saw two lodes, as I conceived, distinct from each other.

Q. You mean on the line of the tunnel?

A. On the line of the tunnel.

Q. Well, now, sir, we come back to the Comstock. As far as the Comstock is concerned, do you think that inspection and prospecting could be carried on by any possibility more vigorously than now?

A. I do, most decidedly. There is nothing that has arrived at that degree of perfection that it may not be bettered. On general principles, it is carried on with a great deal of activity at the present time, yet that activity could be redoubled by increasing the force applied.

Q. About how deep is the deepest mining now done in any silver mine?

A. Three thousand feet.

Q. How long has that company, to which you refer, been in getting down three thousand feet?

A. Well, the mine that I refer to especially—the Sampson mine—has been hundreds of years.

Mr. SESSIONS. Where is that located?

A. In Germany.

Mr. SUNDERLAND. In the Harz mountain, ain't it?

A. Yes.

Q. They have been hundreds of years getting down 3,000 feet? How long has the Comstock been mined?

A. Some 10 or 11 years.

Q. If the same energy that has been evinced heretofore in working the Comstock should continue, how long would it take them to get down 3,000 feet?

A. Probably in the course of 5, 6, or 8 years they might get down to the depth of 3,000 feet.

Q. Is there any instance on record anywhere in the world where the same energy has been displayed in mining as has been displayed on the Comstock, where work has been pushed to such an extent? I speak of silver mines.

A. Oh! there has been a vast amount of energy displayed there, probably more than in any other mines in the world.

Q. What is your observation of the intelligence of the men who are working these mines, the superintendents especially?

A. Well, I think the superintendents, as a class, are very superior men. I think they are men of energy, and gentlemen in their address. Some of them are quite polished in their manners and extremely hospitable. They are very excellent men, as far as my knowledge of them extends.

Q. Now, what do you say of their adaptability to the business that they are engaged in?

A. That I cannot answer. They are generally intelligent gentlemen. They have been selected with reference especially to their mining knowledge, and with reference to their general ability for conducting the business. They are business men—mechanics.

Q. Is it not the habit of superintendents to visit and go through all the parts of the mines that are being worked once every day?

A. Well, that is the case with some; with others it is not.

Q. Do you know whether these men were miners before they were made superintendents?

A. I know some of them were interested in mining previous to their being appointed superintendents, especially in placer mining. I know that is the case with Mr. Requa. With reference to the previous history of these men, I am not acquainted.

Q. Do you know anything about Mr. Requa's knowledge of milling, whether he is a practical mill-man?

A. I should think he was. He is a man of very general information with reference to mines and mining and milling, and everything pertaining to those branches.

Q. Do you know whether he knows anything about machinery, such machinery as is used in hoisting works or in mills?

A. Yes, sir.

Q. What is the character of these men? What character do they sustain in the community where they are known?

A. They are considered, in society, as very respectable men.

Q. Have you any reason to doubt the correctness of their reports that you published in connection with your report?

A. I have reason to doubt some of them; because some of the statements in them are not correct.

Q. What are they?

A. Those that are given merely as matters of opinion. My opinion does not correspond with theirs.

Q. I refer now to where they profess to state facts. Have you any reason to doubt the facts as stated?

A. Where they state facts *as facts*, I should believe them. Where they state them as matters of opinion, in some cases I should not.

Q. Where they state that it has cost so much a foot to sink a shaft or to run a drift, giving the time and cost of such?

A. I should rely upon it with perfect safety; but where they state that they can draw up from the depth of 3,000 or 2,500 feet as cheaply as they can draw up from a depth of 500 feet, I don't quite believe it; I don't think it is a possible thing.

Q. I believe you stated you were once interested in mining stocks on the Comstock. What company was that?

A. It was in the one that Mr. Requa has control of, and several others.

Q. What are they.

A. There's the Overman for one, if you want to put that down; there's the Overman, and there's the Chollar Potosi.

Q. Did you know anything about how those mines were worked at that time?

A. Well, I bought merely as an investment. I studied the proceeds that had been paid, the amount that was being

monthly distributed, especially with reference to the Chollar Potosi, and did it as an investment.

Q. Do you know what it cost at that time to mill ore, or to reduce ore at the mill? Do you know what they charge at the mills for the reduction of ores?

A. No, I don't. I had no personal knowledge of it.

Q. About what year was that?

A. It was about 5 or 6 years ago.

Q. Then that would be covered by this report that I showed you last night? Did you read Mr. Requa's last report?

A. I have read it.

Q. Did you notice that in that report he says that the cost of mining and milling in the Chollar has been reduced about \$1.50 a ton since the year 1870—in his last report from the previous year, I mean?

A. It may be so stated; I don't recollect.

Q. Well, don't you know that it might be done, or were you not told, when you were there, by reliable men, that the cost of both mining and milling is constantly being reduced?

A. I know it is reduced from what it was originally, in consequence of the greater cheapness of milling; and the cost of labor was reduced from what it was when miners were paid enormous wages.

Q. You are mistaken about that. Wages are higher now than they ever were before.

A. I will refer you to the report of the United States Geologist on mining, in connection with that, where it says:

"They demanded their \$16 a day and got it."

Now it is \$4 a day.

Q. Sixteen dollars a day?

A. Sixteen dollars a day.

Q. Who makes that report? I should like to know.

A. Well, I happen to know, because I paid that for it.

Q. Paid \$16 a day?

A. Yes, sir.

Q. For mining? Where?

A. At Mormon Island.

Q. I am speaking about the Comstock, Doctor?

A. We are speaking of mining generally. Specify what you want.

Q. I will now ask you whether the expense of both mining and milling upon the Comstock lode, since it was first worked, has been reduced every year?

A. I know it has been reduced. Whether it has been year by year I cannot say.

Q. Are you not aware that materials, such as timber, lumber, wood, are delivered now at the mines at a much cheaper rate than they used to be, in consequence of the completion of the road between Virginia City and Carson?

A. I should think that that was undoubted. Have you the report of the Savage mine there?

Q. Yes. In that connection, Doctor, I will just get you to mark there a single sentence in the report of last year:

"A branch track of the Virginia and Truckee railroad is being laid above the mining works, which will be a great convenience in the delivering of timber and wood at the mines, and will save to the Savage company 50 cents per cord on wood, and the same sum per thousand feet on timber."

This is the report of the Savage. I presume that would be correct.

Q. Well, now, did you want to refer to anything else there, Doctor?

A. I want to refer to the net proceeds of the Savage Mining Company for the last year.

Q. Well, the net profit is about \$8,000, if that is what you want to get at. I think you will find it in Mr. Holmes's (the secretary) report. I think the aggregate cost will be given in the report.

A. Here it is: The total product of the mine, as given here, is \$827,230.46. The costs of reduction of ore and labor and various expenses make an aggregate of \$818,719.78; leaving a total profit of \$8,510.68. They had a balance on hand the year previous.

Q. Has not the construction of that railroad had the same tendency to lessen the expense of transportation?

A. It has lessened transportation, I judge, because the wagoners complain of the railroad, and say it has driven a vast number of teams out of employment.

Q. In looking at the present expenses of milling and mining, it seems that you have taken the cost to the mining company of milling, and not the actual cost of reduction at the mills. Is not that so?

A. I have taken the cost as given by the superintendents—the cost to the mines.

Q. Well, don't you think it would have been much better, in order to report upon some better mode of reducing the ores, for you to have ascertained from the mills the actual present cost to reducing ores?

A. In other words, to have asked the presidents of the companies what their profits were in reducing ores. We did not have quite cheek enough to make that inquiry.

Q. You were not refused any facilities in inspecting books, papers, or anything else that you asked for, were you?

A. No, sir; but I should have considered it a great impertinence to have asked.

Q. Mr. King speaks of having access to the books of the Savage company, upon which he founds his report. I think you said you did not ask to see the books of any company?

A. Well, we had the books exposed to us, and looked over them; one or two of the companies did this. We just glanced over them, and we saw they were very handsomely kept.

Q. Everything is kept in detail, is it not?

A. It seemed to be kept in very fine order.

Q. So that, by referring to the books, it is easy to ascertain the cost of sinking a shaft, or running a drift, or the cost of pumping, or the cost of any one thing that is done about the mines? It is all on the books?

A. In the most of cases they kept these matters distinct; in others, according to their reports that I now speak from, they lump them together. The different items are put

under one head. It is possible they may run a side drift, and the side drift may not enter as a separate account, but generally you are correct in your position.

Q. You speak of the importance of this tunnel in a scientific point of view. Would it not be as important to run to any other mines in the State of Nevada in a scientific point of view?

A. If the conditions were similar, and the formations the same, it would be. If you can find the same conditions, it would be just as well to run one as another, for the purposes of establishing the principle of the extension of mineral down to the lowest depths.

Q. I understood you to say that the running of the tunnel would induce capitalists to invest their money in the Comstock, or in the work of mining or milling, I don't know which?

A. Where a capitalist is sure of meeting with a return for his investment, he is a good deal more likely to put his money in, than when it is a risky operation.

Q. Well, don't you think these mines are selling for all they are worth now?

A. I think some of them are selling for their full value, perhaps; yet that is a matter of conjecture merely.

Q. Did you ever notice any want of capital there for the purchase of mining stock or the working of the mines, the erection of machinery or the building of mills, on the Comstock?

A. I could give numerous cases where there has been a want of capital on the Comstock in connection with the mills, and one case where washerwomen and others were called on to contribute to the putting up of a mill; that mill soon failed, however, from a refusal to furnish it with ore, or to supply it. The mill failed, in consequence of their failure to fulfill the ideas held out that they should be supplied with all the ore that they could work. They were compelled to sell the property at a very great sacrifice, and pass it into the hands of the mill company.

Q. That was a failure on the part of the parties who erected the mill: they erected the mill, didn't they?

A. They erected the mill, and were for a time supplied with the necessary ore.

Q. Couldn't make it pay, could they?

A. Oh, they made it pay as soon as they got ore.

Q. Well, how did they fail, so long as they made the mill pay a profit?

A. The party that got up the mill was Doctor de Tavel.

Q. Where was that man?

A. He was in Virginia City somewhere; whereabouts I don't know. I never took the trouble to inquire. I know that the stockholders lost their investment.

Q. He called on the washerwomen for money to build his mill?

A. Yes, sir; the washerwomen and all the French residents of Oakland and the surrounding country.

Q. Did he profess to be a scientific man?

A. Oh, yes.

Q. Was he?

A. I don't say he was.

Q. He professed to be?

A. Yes.

Q. I suppose so. When you were there last, Doctor, did you notice any improvements going on anywheres—any mills being built, or any evidence that there was capital there sufficient to carry on the mines?

A. There is no doubt about there being capital sufficient to work the mines. There was evidence of improvement, in consequence of the strike that had been made in the Crown Point, stimulated again by the occurrence that took place while we were there, of striking a bonanza in the Belcher mine.

Q. Don't you know that for the last ten years, if any mine on the Comstock, or any mining company, whether it has had ore or not, has wanted money, it has always been able to borrow, whenever necessary to prosecute researches?

Q. They are levying assessments continually, and I conclude from that they want money.

Q. Well, they have always got it, haven't they?

A. Well, they have, generally.

Q. What benefit would an additional capital, invested in the Comstock, be to its working?

A. Whatever reduced the cost of the reduction of ores and increased the amount of the paying product, or favored the investigating of lower depth, in the cheapest possible manner would be an advantage to the Comstock lode, an advantage to the stockholders, and an advantage to the whole of the United States.

Q. I don't understand that that is an answer to my question?

A. I think it is.

Q. Will the addition of capital now existing bring about the cheaper reduction of ores, and the cheaper mining and more extensive explorations?

A. I think the greater facility offered at the mouth of the tunnel, from the conformation of the ground and the use of water power there, would decrease the cost of reduction materially.

Q. Well, does additional capital necessarily take the ore to the mouth of the tunnel?

A. Additional capital facilitates it, because it requires capital to construct the tunnel.

Q. Hasn't Mr. Sutro told you that he has now \$1,000,000 that he procured in Europe for the construction of the tunnel?

A. No, sir.

Q. Has he told you that he had any money?

A. He told me that he had obtained capital in Europe, but how much I don't know.

Q. He did not tell you?

A. I don't know that he did. He didn't say \$1,000,000.

Q. Well, what did he say?

A. I understood from other parties that he had raised a half million. I think Mr. Sutro never told me of any

amount that he had raised, only that he had raised money there.

Q. Did he tell you how he had raised it?

A. I suppose by the sale of stock.

Q. Well, did he tell you?

A. He did not tell me.

Mr. RICE. Well, may it please the committee, I don't think that what third parties say is of any consequence in this examination.

Mr. SUNDERLAND. I didn't call for what third parties said.

Mr. RICE. Well, he said he got it from third parties.

Mr. SUNDERLAND. I would speak, now, about getting information from Mr. George Atwood. Do you know anything about him?

Mr. NEWCOMB. I know that he is said to be the superintendent of the Eberhardt mine.

Q. Where did you see him?

A. I saw him in Oakland and in San Francisco.

Q. You don't know that he was superintendent of the Eberhardt, do you?

A. I repeated what I was told about it.

Q. How long a time did you see him about San Francisco and Oakland?

A. I was there but a short time myself: I saw him there two or three days. After making all the inquiries I wished in respect to it—

Q. He is a scientific man, too, ain't he? Or he professes to be.

A. He professes to be acquainted with mining.

Q. You say that he told you that he was willing to pay \$2 50 per ton for ore taken from the 200-foot level of the Crown Point, taking fifty tons a day for five years?

A. He would take it out at his own expense; he would be willing to pay \$2 50 a ton for it, and agree to take out that quantity for that length of time.

Q. He was at one time employed in the Crown Point, was he not?

A. He was represented to be.

Q. Do you know in what capacity?

A. I do not: I think it was as foreman of a level.

Q. He also told you that he knew of bodies of ore in the mine that the present superintendent knew nothing about, did he not?

A. He stated so.

Q. What would you think of the good faith of a man that is employed in a mine, who finds ore and refuses to disclose its whereabouts to the company?

A. If employed by me, I should consider him as being derelict in his duty, of course.

Q. Well, don't you think it is a good deal worse than that?

A. Well, that is a pretty heavy charge. I should not like to make it any worse, because it might affect many of the superintendents out there. I don't want to make it any stronger.

Q. I don't think, Doctor, it is in very good taste to make these insinuations against those superintendents.

A. No, they don't consider it so. One of the superintendents told me that they were in the habit of taking the low-grade ores, which would not pay the expense of milling, and mixing them with good ores, to furnish the reduction works with material, thus cheating the mines absolutely out of the cost of that reduction.

Q. Who was that superintendent?

A. I didn't name him.

Q. You decline to give his name?

A. The statement was made in the presence of the superintendent of the Crown Point. I don't wish to involve the character of any individual, but to me it looked as though he was derelict in his duty.

Q. Would you take for granted the word of a man to be true who, at the same time that he told you what he said to be a fact, told you that, while employed by the Crown Point Company, he knew of bodies of ore that would last

five years, and yet refused or declined to inform the company where those bodies of ore were?

A. I don't know but that he informed the company; I cannot say. The same superintendent is not there now. It may have been known, but would not pay for getting it out at that time.

Q. Do you know what responsibility there is about Mr. Atwood, as to his being able to comply with the contract, such as he proposed to make with the Crown Point Company?

A. I don't know anything about his circumstances at all.

Q. Do you know anything about his career as a mill-man?

A. No, sir.

Q. Did you ever hear anything about his making repeated failures there in running mills?

A. No, sir; I never heard of him as a mill-man at all.

Q. Well, there are a great many other things that I want to examine the Doctor about, but I have taken up about 50 minutes, and I guess I will close, in order to not detain the committee and the witness here.

Mr. SUTRO. Doctor, I will ask you a few questions. Mr. Sunderland has asked you whether you saw the water in this Sierra Nevada mine, and you said that they were working the surface simply?

A. Yes, sir.

Q. Would there be likely to be any water on the surface?

A. If there had been, it would have been drained off or evaporated.

Q. Could the surface diggings at the Sierra Nevada mines properly be called a part of the Comstock lode? Are they not more of the character of placer diggings?

A. Well, we considered it in that light. They were working from the surface, and working for gold.

Q. You were asked whether the Sierra Nevada mine would not be benefited by the tunnel as they were working now. You answered that it would not. Would not

the Sierra Nevada mine be benefited by that tunnel, if they were to penetrate down in depth?

A. Well, that is a question that cannot be answered positively. It might, and it might not. It is possible that you might strike the lodé as rich at the depth of 2,000 feet, or you might strike bad rock.

Q. Would not it facilitate their prospecting operations?

A. Not in their working on the surface.

Q. But provided they would connect their shaft by a bore-hole with the drainage tunnel, would it not aid explorations of that mine in depth?

A. It would aid in exploration if the tunnel ran under it; which I do not contemplate that it ever will.

Q. Well, there is no telling about that.

A. That is true, we cannot tell; it may or may not.

Q. Why didn't they work in depth in the Chollar mine?

A. They had struck a bonanza upon one of the upper levels, I don't recollect what one; it may have been the 300-foot level or the 500-foot level that they had been working on. By the report of the superintendent, they had been working up a rich bonanza which they had discovered.

Q. Did they not gouge out that ore, so that they might make large dividends and run up the stock?

A. I don't know. It was the opinion of Mr. Requa that there was no rich ore in the mine at great depths; he held that the mine would be exhausted when the upper levels were worked out. I considered it an entirely mistaken opinion; but still he attempted to demonstrate it from the maps that had been offered.

Q. What is the *modus operandi* of mining, Doctor, just as it is done there? Do they not go down in their shafts, and, when they open up a new level, then work upwards to the next level above?

A. Yes, it is cheaper to work upwards than downwards.

Q. Do they ever work downwards?

A. Only in shafts.

Q. In order to get down in the mine, do they not put their shafts down, and then go into the mine and work upwards invariably?

A. It is their rule. They run their drifts, and if they discern a body of ore, they work up by stopes.

Q. Then let the ore drop down?

A. Yes, sir.

Q. Then carry it to the shaft and hoist it out?

A. Yes, sir.

Q. Well, supposing you go in by the tunnel and work upwards, there would be no necessity to keep sinking these shafts and opening up one level at a time?

A. It would be just as easy to work upwards from the tunnel as to work up from these preparatory drifts. It is just as easy to work from the tunnel as from those little drifts.

Q. Doctor, does not the opening up of one level at a time keep the future of the mine entirely in the dark?

A. What is below is kept entirely in the dark necessarily?

Q. Well, does that not give rise to all kinds of stock jobbing operations, this being in the dark and not knowing anything about it—the owners of the stock not knowing what is going to be found, and the managing men in the mine knowing of the discovery of ore first?

A. The best possible answer to that would be that the Crown Point was reported at \$2 50 a share; the stock, in consequence of the discovery that was made of the bonanza, went up to \$300 a share, and has gone up to still double that, as I understand. Those who first discovered the bonanza would have had the advantage of operating by telegraphing for the purchase of stock.

Q. Is it not common report, and known to everybody, that these mines are managed and worked not so much for the benefit of the stockholders as for the benefit of those rings who control them?

A. Well, it has been so represented. I will not give it as a matter of absolute knowledge that I have myself, but

it has been generally understood so, and I have had my views in regard to it for many years that that was the understanding.

Q. Isn't it a notorious fact, known to everybody, that these mines are simply worked for stock-jobbing, and in order to bull and bear the market?

A. No, I think it is for the bullion as well.

Q. Isn't the extraction of the bullion simply a secondary consideration?

A. I should consider it so with very many that are following the business for a livelihood. There are many men that follow as a business these stock-jobbing operations. It makes it a species of gambling. They really care nothing about the results, if they can buy the stock at a low price and get it up.

Q. Do these people hold these stocks for investment, or do they buy from day to day, and have new sets of owners continually coming in?

A. I know I invested not as a matter of speculation, and lost upon it.

Q. Do you know anything about the amount of the speculation in stocks in the stock board of San Francisco in the stock of these mines?

A. It is very fluctuating. It varies with the feeling of excitement and the season of the year also.

Q. Does it not amount sometimes to \$10,000,000 a month and more?

A. Well, I should judge it might.

Q. Do you consider, Doctor, that this mode of mining—this making a gambling operation of mining—is beneficial to the interests of the Government and to the people at large?

A. I don't think it is beneficial to the morals of the people.

Q. Does it not have the influence of keeping people who are at a distance, and have capital—people in the East—from investing in these mines? Are they not afraid that they will get swindled?

A. Well, it is almost proverbial that a man who is not in the ring, as it is called, who invests his money, is pretty sure to lose it.

Q. Doctor, if you were living in New York, would you own stock in any of these mines, without being able to watch every movement that is going on there?

A. Well, I would not want to own stock at a distance. I would rather my money should be invested at 7 per cent., a great deal, than to have the richest stock in the mines at the present time, as they are now conducted, with a prospect of doubling my money every six months.

Q. Would you want to have an investment in those mines without being near them?

A. Losses don't trouble me very much; I have been accustomed to them; so I sleep pretty well generally.

Q. Doctor, would not it be very desirable for the interests of the Government and the people at large that a legitimate and thorough system of mining should be introduced whereby it would be brought down to a regular business, as much so as the manufacture of iron in Pennsylvania?

A. I think it would be of very great advantage to the mining interests of the Government and of the country at large to have a perfect system of mining.

Q. Wouldn't it have the tendency to move capital in that direction, to these Western States and Territories, and open up the mines and mineral wealth?

A. It would have that tendency.

Q. Now, I will go back to some questions Mr. Sunderland put to you. He asked you if there was any water in the Chollar mine where they were working. You said there was none. Why was there no water; was it near the surface?

A. Well, it was on the upper levels; if there was any water dripping, it would get into the deep shaft.

Q. They had abandoned that?

A. They had.

Q. Because it was very expensive to work it?

A. The reason Mr. Requa gave for not working it was,

that there was no mineral at the low levels; that the mineral was being exhausted in the mine. The feeling, before this strike was made, was pretty general that the mines were exhausted; that the lode was worked out. That was the general impression previous to the discovery of the bonanzas. I was told that that was the general impression. It renewed their courage when the bonanza was struck at this low level in the Crown Point. It was increased in intensity, and the thing began to change pretty thoroughly, when the adjoining mine, the Belcher, struck a very rich bonanza; and that is still further confirmed by the recent discovery of the Savage mine. Our report was made with the understanding that it is a true fissure vein: from our observations, as carefully made as we were capable of making them; we came to the conclusion that it was a true fissure vein, and that the ore would be found at great depth. You might have to work through a barren field in order to strike it, but as long as you kept within the walls of the country rock, on the one side and the other, there was a possibility of finding rich bodies of ore.

Q. In regard to striking water in depth, Wheeler's Stock Report of January 26, 1872, says:

"The superintendent of the Crown Point, in a letter of the 7th instant, in speaking of the 1,300-foot level, says: 'On the 1,300-foot level nothing is being done, and nothing will be done, until the water is drained off, which will probably take three weeks.' This mine has one of the most powerful pumping works upon the Comstock, and yet so great a headway was gained by the water, that work was forced to be stopped in a certain portion of the mine."

Do you consider it likely that they will strike those accumulations of water at any point and at any depth?

A. Well, they may occur at any depth where they strike a clay seam.

Mr. SUNDERLAND. That report don't say where that water comes from.

Mr. SUTRO. It says they struck it there, and it drowned them out.

Mr. NEWCOMB. It didn't make any difference whether it came from the surface or below. If they get a wet winter,

they will get a large quantity of water; and if a dry winter, they will get less of it; and in a succession of dry seasons there will be less from the surface. Common sense teaches that.

Q. He says, in the same article:

“Men of ingenuity set themselves to thinking, and pumps of considerable more force were invented, which, for a time, were successful in obviating this difficulty; but now shafts have been sunk to such depths, that more powerful machinery must be put in use; and in a few years another change will have to be made, for the power will then be too light for the depths that will be attained. Vast outlays of money will be required to put this machinery in place, and work in the mines for the time being will likely be stopped. The aqueous fluid seems to have turned out to be the greatest obstacle that nature has presented to human skill to conquer in the mines of the Comstock.”

That is dated January 26, 1872; that is the official report.

Mr. SUNDERLAND. There is no official report at all.

Mr. SUTRO. It is taken as authority by everybody who has anything to do with the mines.

Mr. SUNDERLAND. Mr. Wheeler states what he thinks.

Mr. SUTRO. He states furthermore that

“Considerable portions of the expense incurred in mining is caused by the hoisting and draining of water, and he who will devise means whereby this difficulty will be conquered, and which will prove permanent, will not only be a great benefactor, but will meet with such a compensation as will place him in a position far above want.”

There is another article here about striking water in the Belcher mine. They struck water there, and they had to give up work in the Belcher mine at their greatest depth. Now, I want to ask you, Doctor, if the water which is encountered in penetrating the crust of the earth is not all derived from the surface, from rain and the melting of snow?

A. Yes, sir; necessarily so.

Q. Well, if the water which we find penetrating the crust of the earth is derived from the surface, is there any limit to the depth at which it may be found in large quantities?

A. The limit is only when you get to the interior or heated portions of the earth; there evaporation will ensue, and the water will be driven off in steam.

Q. Is there any possibility that there will be any less

water struck in going down 4,000 feet than at the beginning?

A. I think it will be lessened in quantity after passing down to a depth, because the pockets that exist above will hold the water. Still they are liable to occur at any depths that you may penetrate.

Q. Supposing, at a depth of 4,000 feet, we have a clay seam, or two clay seams, coming together and forming one of these bowls that have been described here, of immense size, would that not contain water just as much as it would at the 1,000-foot level?

A. It wouldn't be so likely to occur at the very low depth you could reach. These strikes were more frequent in which the early stages of mining than in the lower depths, is an evidence that they decrease in number as you descend.

Q. Mr. Day, in your report, states the cost of working the Ophir mine. Mr. Deidesheimer, the present superintendent, furnishes some additional figures on that subject, taken from the books:

"OFFICE OPHIR SILVER MINING COMPANY,
"VIRGINIA CITY, February 16, 1872.

"ADOLPH SUTRO, Esq.,

"Washington, D. C.

"DEAR SIR: Your telegram, asking for figures in detail and cost of pumping, came duly to hand.

"I have seen Mr. Graves, superintendent of Imperial, and am informed by him that the statements you desire cannot be furnished here.

"Accompanying this please find detailed statement of cost of Ophir new works, 'Buck's shaft,' from time of breaking ground, in 1867, to January 1, 1872; also, actual cost of raising water.

"The indirect cost, as noted, we estimate as being the amount that our current expenses would be reduced had we no water to contend with.

"Trusting that these will meet your requirements, and be of service to you, I remain, very truly, yours,

PHILIP DEIDESHEIMER,

"Superintendent."

This is the statement:

"Cost of Ophir new shaft from August, 1867, to January 1, 1872, including pumps, bobs, air conductors, and all underground work and machinery.....	\$415,936 09
Cost of building over shaft.....	7,159 03
Cost of machinery, &c., including labor and material.....	172,541 35
General expense, &c., salaries and office expense, &c., August, 1867, to January 1, 1872; \$38,824 32; one half applied to cost of new works.....	19,412 16
Total cost of new works, 'Buck's shaft,' from time of breaking ground, August, 1867, to January 1, 1872.....	<u>\$615,048 63</u>

Dimensions of shaft outside of timbers, 18 feet 8 inches, by 7 feet 4 inches.
 Depth of shaft, January 1, 1872, 1,255 feet. No. of feet of drift and winze to January 1, 1872, 2,900 feet."

Deducting the cost of machinery and other expenses, we find that it has cost \$415,936 09 to construct that shaft. Don't you consider, Professor, that the bulk of the expense of making that Ophir shaft has been caused by the troubles which water gave them?

A. Well, I am not posted upon it so as to give a decided answer. I know that that is one of the great expenses attending the sinking of shafts generally.

Q. When you were out there, you made application to visit the Savage mine and the Hale and Norcross, and obstacles were thrown in your way?

A. I don't know whether they were obstacles thrown in our way; one thing after another occurred to prevent. They represented that the shaft was out of order in one case, and we know that they were pumping very actively to clear the mine of water at the time, and it slipped by from one day to another. The superintendent did not give us the notice that we expected from him, when he would be in readiness, and the whole time passed without our receiving it.

Q. While you were there, did they run the pumps at the Savage mine and the Hale and Norcross to their full capacity, day and night, in order to get their water out?

A. Not the whole time. They did a considerable portion of the time.

Q. How powerful is the machinery in the Savage mine, as compared with the machinery in other shafts? Is it not the most powerful there is on the Comstock lode?

A. It is considered, I believe, one of the best pumps on the lode.

Q. Do you recollect that there are four large steam-engines on that shaft—one immense steam-engine?

A. They have very powerful machinery generally. That is about all that I recollect about it. We turned the machinery part over to the investigation of General Foster.

Q. Well, all that ponderous machinery was kept going

on both those shafts? They couldn't work on the lower level on account of the influx of water?

A. I heard the workmen speaking of how nicely they had let the water run from one shaft to another that was a little lower. They were chuckling over it.

Q. Taking the statements of the superintendents of the Ophir company and the Gould and Curry company, we find an average of 411 tons of water which they have to hoist out, or pump out, every 24 hours. Taking that as a basis, how much more water would there be encountered on the whole Comstock lode?

Mr. SUNDERLAND. I object to that, until the Doctor says the statement is right.

Mr. NEWCOMB. I don't want to agree to an estimate of it; because it might form an exceptional case, and it wouldn't be fair.

Mr. SUTRO. Doctor, in your report I find that you have averaged the cost of pumping. You state here, on page 8, that the cost of pumping for the year ending June 30, 1871, as arrived at by the commissioners, by taking the costs as given by the miners so far as reported, and estimating on the others, was \$124,674.

Mr. NEWCOMB. We gave also the statement of Captain Day on the subject, who estimated it at \$150,000. There had been three dry seasons. Those dry seasons influence the amount of water, and it is only when they strike the pockets that the water disturbs them. A wet season would cause a larger amount of water to penetrate into the mines, and will give them disturbance in the future. I think the computation of the water was made by General Foster.

Q. Taking the quantity of water at the end of these three dry seasons, as given here by those two gentlemen, and supposing that these figures are correct—that there are 411 tons pumped every 24 hours, on an average, between the Ophir mine and the Gould and Curry mine—how much do you think the average would be on all the mines of the Comstock lode—say 30? You have made an estimate here, aver-

aging it, and it would be perfectly fair to arrive at another average, by taking the 411 tons as a basis.

A. I don't think it would be a fair estimate, but I think that the estimate would be that perhaps ten out of the thirty shafts would yield an equal quantity of water each.

Q. Well, taking the ten, that would be 4,110 tons for every 24 hours. Now would you consider that one-half that amount for the other 20 shafts would be fair? These figures are well established. Every mining engineer knows how much a miner's inch will discharge every 24 hours.

A. I don't think the other 20 mines would average a half or a quarter.

Q. Well, say a quarter. That would give us 6,000 tons of water per day to be pumped out of the Comstock. That would be a pretty low estimate. Now, suppose these 6,000 tons were let out through the tunnel, wouldn't it be an immense saving to these mining companies, Doctor?

A. It would save all the expense of pumping it.

Mr. SUNDERLAND. Do I understand you to say that there is that amount of water pumped out?

Mr. SUTRO. No; it is merely an estimate. It is an estimate based upon their own figures here, furnished by the superintendents.

Mr. NEWCOMB. I haven't gone into the computation.

Mr. SUNDERLAND. What do you think of the approximate accuracy of that?

Mr. NEWCOMB. It is very much larger than I supposed.

Mr. SUTRO. According to Mr. Day's figures, they had 18 inches of water in that mine alone in June, 1870, which is equal to 1,700 tons for every 24 hours. Now, do you think that if they had 1,700 tons in one single mine, the estimate of 6,000 for the whole of the lode is exaggerated?

A. Well, it would be more than was produced at the time we were there. I found them working upon dry levels in some cases, where they didn't have their steam-pumps in operation; in others, they were throwing out large bodies of water; in others, the drippings required us

to be sheltered by India-rubber coats, to prevent our being deluged.

Q. Doctor, you have been asked the question whether they couldn't use water power at Virginia City. Do you know how much water sells for at Virginia City?

A. I heard, but I have forgotten. For some enormous sum.

Q. Well, it is stated at \$1,000 per miner's inch per month. It is a well-known fact that the water company made dividends amounting to \$15,000 a month. Do you think, Doctor, at the cost of water here, it would be possible to employ it at all for mining or concentrating operations of any kind?

A. Well, the mode of operations must necessarily be very crude, for the want of proper water power. The supply is not constant.

Q. You were asked about the Lady Bryan mine. Does that belong to the Comstock lode?

A. No, sir.

Q. What is the average distance of the mills on the river, by railroad, from the mines to Virginia City?

A. I believe the most distant one is some 23 miles.

Mr. SUNDERLAND. Yes, sir; 22 miles.

Mr. SUTRO. Well, call it 22. How far would the mills be from the mines if these mills were transferred to the mouth of the tunnel?

Mr. NEWCOMB. From 4 to 6 miles; 5½ miles would be the most distant, probably.

Q. Over a level railroad, almost?

A. Yes, sir.

Q. You were asked whether Empire City would be flooded. If this would be so, do you see any difficulty in erecting a levee there?

A. I see no difficulty in putting up a levee.

Q. Then it would not flood Empire City at all?

A. Of course not, if the levee were erected.

Q. Mr. Sunderland read extensively from Mr. King's report last night in regard to the loss of working. These

data are based upon the statements made by the mill-owners. Do not the same parties that own the mills control the mines?

A. I understood when I was there, and I heard it from Mr. Sharon himself, that he had the control of some of the mines.

Q. Doesn't he exercise a great influence over many of the mines?

A. I can't say as to that absolutely. He told me that he had control of the Belcher.

Q. I want to ask you whether the tailings from the ore are not claimed by the owners of the mills?

A. The mills, I believe, are entitled to the tailings, unless the mill itself belongs, as in one or two instances, to the mine.

Q. I am speaking about the Union Mill and Mining Company. They get the tailings after they work the ore?

A. So I was told by the mill operators, the superintendents of the mills.

Q. Well, wouldn't it be for the interest of those mill companies to make as good a show as they could to you?

A. I suppose so.

Q. Supposing, in reducing the ore, they should lose 50 instead of 35 per cent., wouldn't the mining companies make a requisition upon them?

A. So I understood. They are obliged to return so much per cent.

Q. So the mill company gets all of the 35 per cent.?

A. They do in the most of cases. I know cases where returns have been made yielding a small per cent. over 65.

Q. Wouldn't these people be very apt, under that system, to keep it up, in order to get all these tailings and accumulate them? Wouldn't they be very apt to try to continue as they are?

A. Self-interest would actuate them, no doubt, to retain the present posture of affairs.

Q. Supposing the ore would be milled and concentrated

at the mouth of the tunnel, wouldn't it interfere with their profits made out of these tailings?

A. If they had no tailings they would make no profits.

Q. Is it not very natural in these people to oppose the new project? Wouldn't they oppose any system of mining and milling that would give a large yield to the mines, and by which they would be the losers?

A. It isn't natural for men to wish to change positions when they are making a good deal of money where they are.

Q. So far as you have been able to judge, what is the actual return to the mines. What yield do they get from the mills?

A. Well, I should think from 65 to 65½ per cent.

Q. It has been stated here in the report, that the statements furnished by these superintendents of the mining companies are official. Are they any more official than any of the other statements that were made?

A. They are official with reference to the companies. We made a series of questions to the superintendents, and we applied to Mr. Sutro for his side of the argument as well. We don't hold ourselves responsible at all for the representations made by the superintendents. They expressed their hostility to the tunnel, and we wished them to draw up as strong an argument as they could make against the tunnel.

Q. Now, I want to ask you, Doctor, whether you haven't found a good many of the laboring men over there in favor of the tunnel?

A. I have conversed with them. One man I found very strongly in opposition to it, and I asked him his reasons: "Why," said he, "I am a teamster, and it would take away my business."

But the general feeling in the community, as far as I can judge, outside of those directly concerned in the mines, leaving the miners out of the question, was in favor of the tunnel. All the laboring population that we conversed with, especially the miners, favored the construction of the tunnel.

Q. Have these laboring men invested their money in this tunnel company?

A. Many of them have.

Q. Have you found many of these men who own stock in the tunnel company?

A. I found quite a number. I didn't make it a special matter of inquiry.

Q. You stated that they have been working in the mines of Europe for hundreds of years, and have not yet reached a greater depth than 3,000 feet. What do you think is the difficulty in getting down?

A. The difficulty has been the water, mainly.

Q. Do you know of a tunnel in the Harz mountains, fourteen miles in length, for drainage?

A. I know there is one that is reported as having been constructed by the government.

Q. Do you know of another tunnel, in Freiberg, that is over eight miles in length?

A. It is so reported.

Q. Do you know of one in Hungary?

A. Yes, sir.

Q. Don't they mine intelligently in Europe?

A. I suppose they do?

Q. Are they not compelled to have systematic mining in order to work their mines at all?

A. Yes, sir; that is well known.

Q. Well, isn't the fact that they have never got deeper than 3,000 feet evidence of great obstacles in getting down?

A. Yes, sir; I think it is.

Q. Don't you think it would be a proud thing for the United States to penetrate deeper into the bowels of the earth than man has ever done before?

A. Well, as an American, I should certainly feel pride in having my own country go deeper than any other.

Q. Would you not consider that, if we should penetrate into the bowels of the earth, and establish a rational system of mining, by which the low-grade ores of that vast region

may be worked, it would appreciate the value of our mineral domain many fold?

A. It would increase it to a very great extent. I haven't the slightest doubt; but no conception can be formed as to the amount.

Q. Can we give any figures to show what wealth is contained in that western region?

A. No; it is rather my opinion that, if we were to get all the bullion from that one lode, we could pay off our national debt in gold and silver at once. That is only a matter of opinion, of course.

Mr. SUNDERLAND. That, you say, is a matter of speculation?

A. That is all.

Q. You don't assert that you know it.

A. No, sir.

HEARING WEDNESDAY, FEBRUARY 28TH.

Examination of Major General H. G. Wright.

Mr. SUTRO. General Wright, you were senior officer or chairman of the Sutro Tunnel Commission?

General WRIGHT. I was.

Q. On page 13 of your report you state, in regard to the feasibility of the tunnel:

"Of the practicability of the project there is no doubt. It is a question of cost alone. So many tunnels have been run in this, as well as in other countries, through material much more difficult, that no reasonable grounds exist for questioning the feasibility of the one we are considering. So far as surface indications are to be relied upon, the rocks to be penetrated do not differ materially from those which are met with in the operations of the Comstock, in the shafts, drifts, and winzes which have been opened in those mines in search for the precious metals. While it is quite impossible to predict with any degree of certainty exactly what kinds of rock will be met with in the progress of the tunnel, or in what proportions, it is safe to assume that nothing will be encountered which will offer any serious obstacle to the miner. We therefore dismiss this portion of the investigation with the expression of the opinion of the commission in favor of the entire feasibility of the tunnel project, so far as its construction is concerned."

General, you have looked into this question of tunneling, I believe, somewhat carefully. You visited the Hoo-sac tunnel?

A. I did.

Q. And witnessed the operations of the present appliances for drilling rock?

A. I have.

Q. Do you think that the progress which can be made is much greater than it was in former times, before improved power-drills were invented.

A. I certainly do.

Q. What kind of drills have you seen in operation there?

A. I have seen what is called the Burleigh drill, operated by compressed air, and the diamond drill, which may be operated also by compressed air or by steam. The first of these may be operated by steam. I would say steam and compressed air for the first, and steam or compressed air for the second.

Q. Which do you think is preferable, generally?

A. I have believed that ordinarily the Diamond drill is preferable. It has not received that amount of actual use which has been given to the other.

Q. Haven't you found in your investigations, General, that the Diamond drill, when it was first used, some years ago, was not applied in the proper manner; that is to say, that they applied a very strong feed and a slow motion; while at the present day they have substituted a very rapid motion, so as to make as much as a thousand revolutions per minute, and a very slow feed?

A. There have been several improvements made in it, one of which is to make the feed automatic and dependent upon the pressure. I am so informed, but I have never seen it working.

Q. Then they get a very rapid motion, and a great many revolutions per minute, with a very slow feed; and at each revolution the diamonds take off an infinitely small portion of the rock?

A. They take off small particles of the rock in the shape of dust.

Q. But with a thousand revolutions per minute they make pretty rapid progress?

A. Yes.

Q. I have seen those drills worked at the rate of an inch per minute. Is that about your experience?

A. I have seen them work in hard rock not so fast as that. Taking a hard gneiss rock, I should think an inch in three minutes.

Q. In the hardest kind of rock?

A. That is a very hard rock.

Q. With the application of diamond drills in this tunnel, considering the kind of rock we have to penetrate, do you think we can make pretty rapid progress?

A. You can make very rapid progress, in comparison with what can be done by hand power.

Q. We are making now from three to five feet per day. How much do you think that could be increased by using diamond drills?

A. As far as mere drilling is concerned, I should suppose you could make five or six times that progress.

Q. As far as drilling is concerned?

A. There are other considerations. There is the blasting, and getting out of the material blasted. The drilling could be proceeded with much faster if you could get rid of the debris.

Q. Under our present mode of running that tunnel, do you think that, instead of from three to five feet per day, we probably would make from 12 to 15 by the use of the diamond drill?

A. If the debris could be cleared out, certainly.

Q. Do you think it could be done?

A. Yes; I should think so.

Q. It is proposed—in fact we are now sinking four shafts on the tunnel line for the purpose of getting down to the level of the tunnel. We have already erected steam-engines on those four shafts, and we are now about to order very large and heavy machinery to carry down these shafts to different depths.

Mr. SUNDERLAND. I would rather have that stated as testimony.

Mr. SUTRO. It don't appear as testimony—what I state, Mr. Sunderland.

Mr. SUNDERLAND. The newspaper accounts differ as to your statement about your having put up that machinery?

Mr. SUTRO. Well, as long as you have any doubt about that, I think I can give you some points on the question.

Mr. SUNDERLAND. So far as I have seen, your machinery is on the way there; but the roads have been very bad.

Mr. SUTRO. I will read a telegram from the superintendent of the works, dated Virginia City, February 27, 1872:

"To ADOLPH SUTRO, *Washington, D. C.*

"Engines on shafts number one and two running. Number one very wet. Working on number four. Roads very bad. Number two one hundred and ninety feet."

One shaft (number two) is already down 190 feet. That was on the 27th, (yesterday,) and that is mostly by hand labor. Now, I want to find a copy of a paper.

Mr. SHOBER. Is that material?

Mr. SUTRO. Well, I might as well set this right, since it has been spoken of. It will take but a moment. Here is the Virginia TERRITORIAL ENTERPRISE of Tuesday, January 30, 1872. It states:

"THE SUTRO TUNNEL FOLKS MEAN BUSINESS.—There is great activity along the whole line of the Sutro tunnel. The company certainly mean business. The engines for each of the four shafts are now on the ground and will shortly be set up. The hoisting gear, and other machinery for the several shafts, has also arrived in the city, but all has not yet been hauled to where it is to be set up. The hoisting frames were brought from San Francisco ready made. They are all of Oregon pine. Breed and Crosby's teams are now engaged in hauling to the mouth of the tunnel the machinery of a first-class machine shop, which is soon to be set up there. This shop will be run by steam, and will contain lathes, iron planers, and all else requisite. One of the lathes alone weighs over 8,000 pounds. Once the hoisting works at all the shafts, the machine shop and all the other shops in full blast, the country to the eastward of the city will present a lively appearance."

Here is the Gold Hill EVENING NEWS of January 30, 1872. It states:

"The preliminary engines and hoisting machinery for the four air-shafts of the Sutro tunnel have arrived, and will shortly be put in working position. The various fixtures, etc., for a first-class machine shop are being brought in, and it is to be complete in every respect, prepared to do any and all work desired in that line by the Sutro Tunnel Company."

In this connection I might as well state, that the amount of money spent by the tunnel company during the month of January, over at the tunnel, independently of anything spent at San Francisco, is \$40,000. I was going to ask you, General Wright, whether, with the use of the diamond drills in sinking shafts, much more rapid progress can be made, than could be in the old manner of sinking shafts?

Mr. WRIGHT. I have no doubt it can be done much more rapidly.

Q. A new system of sinking shafts has been spoken of by some of the engineers, I think, of the United States army, and I don't know but it has been employed at Hell Gate, New York, or some other place, by which they propose to sink down bore-holes all round the circumference of a shaft to a depth say of 500 feet at a time, then fill up those holes with sand within five feet of the surface, load them with giant powder, and discharge all at once by a

galvanic battery. Have you heard of that operation, General?

A. That has been proposed for running drifts; that is, to bore this series of holes to the greatest depth that it is economical to bore them, (not to the greatest depth to which we might possibly bore them.) If it were 50 feet, it would be 50; if 20, it would be 20.

Q. What do you think about the feasibility of that plan, General?

A. I don't see why it shouldn't be feasible. I have advised its use myself in the works of Hell Gate.

Q. You advised the Government to use it?

A. The officer in charge of the works.

Q. That is for drifts?

A. For drifts. They are running at this time no vertical shafts at all. It is one great vertical shaft, to a very large extent, from which the different drifts are run out under the water.

Q. Do you see any difficulty in sinking the shafts in the manner I have described?

A. I see none whatever.

Q. We propose to try experiments upon that plan of sinking. Would you consider it judicious to do so?

A. I certainly should.

Q. Well, if we should succeed in putting our bore-holes down 100 feet at a time, and then fill them up, as I have said, with sand, and then place the giant-powder or nitro-glycerine, do you not think we could remove more than in any other manner?

A. Possibly so; but I think the great advantage would be in setting the boring machine but once for a hole of great depth; that is, instead of boring down to the depth of five feet and then removing the machine until the explosion takes place, you bore it down to five charges, ten charges, twenty charges, and then fill it up with sand, and then remove your machine, and you don't have occasion to replace it again until you have arrived at the bottom of the hole by these successive explosions.

Q. By putting this drilling machinery, to start with, on the top, it could be driven by a steam-engine on the surface; could it not?

A. Undoubtedly.

Q. Then, on reaching down, it could either be run by compressed air or by steam carried down from the boilers?

A. Undoubtedly. Either power would answer; the one which is the most economical being the best.

Q. We propose to try both modes. Which do you think would probably be the most advantageous to use—compressed air or steam—in running this machinery in sinking the shaft?

A. In cases where the power has to be carried a considerable distance from the place of its manufacture the compressed air is undoubtedly the best. You may attain a distance, as they have at the Hoosac tunnel, of nearly two miles. It would be utterly impossible to work these machines by steam generated outside the mouth of the tunnel, because, in carrying it in, the steam would condense.

Q. So the advantage would be in the use of compressed air, which loses less of its force in being carried a long distance?

A. Very much less.

Q. How much did you find the loss to be at the Hoosac tunnel?

A. They called it two pounds in fifty-five or fifty-six, I think. That is about it at all events. That is, it was sent in with a pressure of 56 lbs., and it was worked at a pressure of 54 two miles in; but that I must say does not necessarily show the loss. Those were the relative pressures at the two ends; but in traversing that distance there is a loss of heat.

Q. Of heat?

A. The compressing of air generates heat, and the air is expanded thereby. As it passes through this line of pipe, to the point where it is applied to the work, it gets cooled down, and as it cools down its tension diminishes; and therefore the statement is not absolutely correct that there

is a loss of only two pounds. They work under only two pounds less pressure than that under which they started.

Q. Then, taking into consideration the cooling off of the air at that distance, there really would be hardly any actual loss of pressure at all? The pressure is not lost in transmitting the air through this long tube or conduit; but it is really lost by the loss of its heat?

A. By the loss of heat. The leakage is really very small, and the difference in pressure, at the two ends of this pipe, which is nearly two miles long, is only about two pounds.

Mr. SUNDERLAND. Two pounds in fifty-six?

Mr. WRIGHT. I give it as my recollection—somewhere near it—55, 56, 57.

Mr. SUNDERLAND. What percentage?

Mr. WRIGHT. That would be a little less than four per cent.

Mr. SUTRO. What is the size of the pipe?

Mr. WRIGHT. I don't recollect. I believe it was an eight-inch pipe.

Mr. SUNDERLAND. Professor Newcomb said the loss was 15 per cent. to the mile.

Mr. SUTRO. No; I don't think he made that statement.

Mr. RICE. He said 15 per cent. for the whole distance.

Mr. SUTRO. I think he must be mistaken.

Mr. WRIGHT. You must be mistaken. I am not mistaken in what they furnished to us.

Mr. SUNDERLAND. Professor Newcomb was examined about a good many things, and that is one of them.

Mr. SUTRO. Do you think there is any difficulty in transporting compressed air through a pipe of sufficient size, say at least eight inches, for five miles?

Mr. WRIGHT. None whatever.

Q. Do you think there would be a considerable loss?

A. Well, that depends upon what you call a considerable loss.

Q. Why, an extraordinary loss. Would you lose 20 per cent.?

A. I should think not; nothing like it.

Q. Would it not be great economy, then, to use water power in applying compressed air to the working of the shafts, of the tunnel, and also the mines on the Comstock lode?

A. Most undoubtedly; it is the cheapest of all power.

Q. Well, about these shafts?

A. If you could secure the water power, of course.

Q. Could the progress of these shafts under this system that we have just described be made a great deal more rapid than by the ordinary way of working?

A. That has been found to be the case wherever it has been applied, so far as I know. I see no reason to doubt it at all.

Q. What do you think about the character of the rocks, generally, from the west wall of the Comstock lode to the mouth of the tunnel? Do you consider them as a class of rocks very difficult to work?

A. I do not.

Q. How would you consider them, compared, for instance, with the rocks encountered in the Hoosac tunnel?

A. Oh, they are very much easier to work.

Q. Do you know anything about the Mount Ceniz tunnel, General?

A. Very little.

Q. You have read about it?

A. I have read about it.

Q. You have read about it very fully, have you not?

A. Yes.

Q. What do you think about the rocks there?

A. I have heard they are very hard.

Q. Do you think they are much harder than the rocks we will encounter in making this tunnel?

A. I think they are.

Q. Would you not consider that the rocks which will be encountered in making this tunnel are more favorable for working than the rocks encountered in other great tunnels which have been constructed? I refer now to the Hoosac tunnel and the Mount Ceniz tunnel especially.

A. If you take the Hoosac tunnel and the Mount Ceniz tunnel, I have no hesitation in answering the question. There are many large English tunnels that go mostly through clay, no rock at all; Baron Richtofen——

Mr. SUNDERLAND. There never has been a dispute about the feasibility of this tunnel, I suppose. I don't dispute it.

Mr. SUTRO. But you don't object to having some additional facts brought out?

Mr. SUNDERLAND. No, I don't object; but I don't dispute your proposition at all.

Mr. SUTRO. In regard to the rock in the tunnel, Baron Richtofen has stated the following, which I will read:

"The facilities for excavating the tunnel would depend mainly upon the quality of the rock through which it will pass. It is a remarkably fortunate incident that the route selected by Mr. Sutro not only gives the greatest depth, is the shortest, has the best facilities for working shafts, but promises also, in this respect, to be the most advantageous. The first 6,000 or 7,000 feet will be through trachyte and trachytic breccia, which, in a broad semi-circular belt of prominent hills, swing from Dayton, by the Sugarloaf, to Washoe valley. Trachytic breccia may easily be worked by the pick, yet is ordinarily solid and dry enough to require no timbering. An idea of its excellent qualities for tunneling may be formed from the fact that, in Hungary wine-cellars hundreds of feet in length are with preference excavated in this kind of rock. The solid trachyte is an excellent blasting-rock. Its superior qualities have caused its general use in Washoe for building material; it was as such applied in the construction of the solid masonry of the Gould and Curry mill. With the use of the drilling machine of Mount Ceniz, speedy work will be made in this rock. The next 2,500 feet will, to all probability, exhibit a great variety of rock, some of which will be rather hard. The following 10,000 feet to the cutting of the vein will most likely consist of the same material as is traversed by the numerous tunnels which lead at present to the Comstock vein. This rock (trachytic greenstone) would offer some obstacles if it were in an undecomposed state; but from the general nature of its decomposition, which evidently was formed from below by ascending steam and vapors during a time of volcanic action, we believe we are justified in the conclusion, that it will be found for the entire length of 10,000 feet of the same rotten nature as in the shallow tunnels at present in existence, and it may have to be timbered the whole distance."

General, do you indorse generally what the Baron states here?

A. Scarcely.

Q. In what points do you differ with him?

A. I think that the idea expressed by the commission will explain my views more clearly than anything else.

Q. Will you take this statement, and point out where you don't entirely agree to it?

A. If it would suit as well, I would much rather give

my own statement than correct his. I think I could do it much more satisfactorily to myself.

Q. Would you consider the statement, as given here, correct, in regard to the facility with which these rocks are worked?

A. All these rocks are worked with great facility, compared with rocks in this section of the country. We have no reason to think that any other rocks will be found than those of which we have several specimens; but in what proportions they will occur, it is quite impossible to say.

Q. Simple guess-work.

A. That is simple guess-work. That has been already proved by the progress of the tunnel. The surface indications do not show the exact character of the rock that will be found on the line of the tunnel level. You will find a character of rock there of which there are no surface indications. No rocks have been found so far which we had not a right to expect on the line. The general character of the rock is easy of working.

Mr. SUTRO. There are varieties, but still the general characteristics are favorable for tunneling?

A. Yes, very favorable.

Q. It is soft enough to work with a pick where it wants support, and where it requires blasting it will stand up of itself?

A. I don't think where it wants blasting it will always stand up for itself.

Q. Not always; but it will in some instances?

A. Some character of rock will, and some will not.

Q. What is the usual mode of constructing a tunnel? Isn't there generally a drift ahead of the general work?

A. It is done in a variety of ways, all depending entirely upon the judgment of the controller.

Q. In constructing the Hoosac tunnel, do they not drive a head drift first?

A. They are driving their head drift the whole width of the tunnel.

Q. But not the whole height?

A. Not the whole height. They take it off from the top afterwards. Many prefer just the reverse proceeding; others prefer running in a drift on the side.

Mr. SUNDERLAND. Well, the Mount Cenis was near the whole size, was it not?

A. I think not. It took them some time to finish it after they got through.

Q. Wasn't there a machine the whole size of the tunnel?

A. No, sir. It was driven by independent groups of drills.

Q. All fastened in the face of a machine? It was a full-sized machine?

A. No. There were several; and it was the same in the Hoosac tunnel. There were several pipes led off from the main pipe that brought in the compressed air to these sets of machines and drove the separate ones.

Mr. SUTRO. General, I will exhibit to you now some drawings of the Mount Cenis tunnel, published by the Italian government, the official report on the work. This (indicating on draught) shows the header of the work. Here is a cross-section showing a portion of the tunnel. That is a drift. Here it gives the size of the drift. According to this they first made a small tunnel there?

A. Yes, they kept it on a little ahead of the other.

Q. Well, isn't that the usual way of making tunnels, to make a drift first?

A. It generally amounts to that, for they blow out a certain part of it in order to relieve the pressure. A few holes are charged first, even when they run a full head.

Mr. SHOBER. The object of running a drift is to give a large working face after it is completed?

A. Yes, sir.

Mr. SUTRO. In making the Sutro tunnel, General, would you consider it wise or judicious to stop work on that drift at the present time, in order to widen out the tunnel, or would you not consider it wiser to wait till we make a connection with the first shaft and then widen out?

A. They might go on together. You make more rapid progress simply by carrying on the heading.

Q. By getting our drift in as rapidly as possible we will make the connection with the first shaft much sooner than we will from the deepest shaft; consequently we will have ample time to widen out these first sections while the connections from the deep shafts are being made. Would it not be economy not to trouble ourselves now about widening out the tunnel, but to wait a connection from the first shaft, and then proceed from the first shaft onward, and then from that time go on and widen out the first section? Would it not be an economy of time?

A. I don't see that it would, necessarily. It might be. It would depend entirely upon the rapidity with which you remove the remaining portion, and, what is very important, get that vast amount of debris to the mouth of the tunnel. I shouldn't like to give an opinion.

Q. Would it not hamper our progress by going on blasting now, without a connection with the surface? Wouldn't it hamper our progress by blasting between the mouth of the tunnel and where the men are at work now, in breaking up the air pipes and interfering with things generally?

A. Unless you had these air-pipes protected it would break them.

Q. Would it be possible to have them protected where you are blasting all along the line?

A. I should think it would.

Q. Wouldn't it be wiser to proceed with our drift and then widen out the tunnel?

A. Possibly it might. I should want to give the matter more consideration than I have in order to answer the question.

Q. What I want to get at is, will we not complete our tunnel quicker by pushing in our drift, or "header," as it is called, as fast as we can; and, after we make a connection with the first shaft, when we are no longer troubled to supply the men with air, widen out the first section, extending from the mouth of the tunnel to the shaft?

A. The drift should be pushed as rapidly as possible, of course. You cannot get ahead of your drift, that is certain. But by the use of compressed air you get rid of a great deal of that trouble of want of ventilation. One advantage of the use of compressed air is, that at every movement of the machine a certain amount of fresh air is given out.

Q. You don't get at my question, General. I will make it still plainer. In sinking the deepest shaft, it will take the longest time to get that shaft down and make the connections from the bottom?

A. Undoubtedly.

Q. Now, the first shaft nearest the mouth of the tunnel is only 500 feet deep, while the deepest shaft is 1,500 feet. After we get the first shaft down and get the connection with the mouth of the tunnel, wouldn't we have a great deal of time to spare between that time and the getting down of the deepest shaft, and making its connection?

A. There would be some time, undoubtedly.

Q. Well, couldn't that time be employed more profitably in widening out the tunnel than doing it now, and hampering the men in some degree in their work in the drift?

A. Yes; to the extent of that amount of time that you have to spare, undoubtedly.

Q. Well, would you consider that the difference in getting down 1,500 feet in one instance and only 500 feet in the other would give sufficient time to widen out the first section of the tunnel?

A. I should think it would.

Q. Cannot you employ almost as many men as you please in widening out?

A. You can employ just as many men as can work to advantage.

Q. Well, you can employ them every two or three or four hundred feet. You can put in a gang of men every short distance in widening out?

A. That certainly might be done.

Q. You hadn't thought of that?

A. I had supposed it could be done at the two ends.

Q. It has been our original plan to proceed in the way I have described, and then widen out the tunnel from the mouth and from the bottom of the first shaft, while we are progressing with our drift beyond.

Mr. SHOBER. What is the distance from the mouth of the tunnel to the bottom of the first shaft?

Mr. SUTRO. It is a mile. In regard to the enlargement of the tunnel, Mr. Carlyle states as follows:

"On the basis that the shafts could be sunk at the rate of 4 feet per day, and the preliminary tunnels run at the rate of 5 feet per day in each direction, the following table will show the time it will take to sink the shafts and make their connections with one another, or with the mouth of the tunnel:

	No. of days given for sinking shafts.	No. of days given for running east preliminary tunnel.	No. of days given for running west preliminary tunnel.	No. days working the connection, days of sinking the shaft, and running east preliminary tunnel, added together.
Shaft No. 1.....	111	351	582	462
Shaft No. 2.....	245	448	463	693
Shaft No. 3.....	359	349	456	708
Shaft No. 4.....	340	475	449	815

"The last column will give the number of days during which the machinery will be used on the different shafts for pumping and hoisting purposes; and the last figures in that column will give the total number of days it will take to finish the whole of the work up to the connection between shaft No. 3 and shaft No. 4, namely, 815 days. The balance of the work on that section will consist of the enlargement of that preliminary tunnel from the connection to the Comstock lode. This can be very quickly done, as a great number of men can be worked on the face; however, the time that it will take will have to be added to 815 days, in order to get the whole time that it will take to put the tunnel through to the Comstock lode, full size and working order. I have had several estimates made by intelligent miners on this portion of the work, and, in their opinion, they think such simple work could be performed at a rate of 40 feet per day. This is an average, and not the result of any of the estimates simply; so I will use it as a safe estimate. This distance to be traversed will be 4,618 feet"——

He is now speaking of the last section.

—"which, divided by 40 feet per day, is equal to 116 days nearly for the whole time; so that 116, plus 815, is equal to 931 days, which is the time it will take to put the tunnel through to the Comstock lode in a complete state."

He speaks here simply of hand labor. - He don't bring machinery into account. If there were a large water power

at the mouth of the tunnel, do you see any obstacle in compressing air for the running of drills in the mines?

A. None at all.

Q. In a distance of four miles from the mouth of the tunnel to the Comstock lode, or say even six miles, do you see none?

A. None.

Q. And you would consider the employment of diamond drills in all these mining operations as greatly advantageous?

A. I certainly should.

Q. Then, by using water power at the mouth of the tunnel, a great deal more rapid progress could be made in the prospecting operations and in the mining operations proper on the Comstock lode?

A. Unquestionably. I advised the superintendents of these mines to examine into the subject.

Q. Do you see any difficulty in carrying in compressed air to the point of intersection of the tunnel with the Comstock lode, and using it there as a power to raise ore and pump water?

A. None. I would remark, although I do not know whether it is proper evidence, that the Government, at Rock Island, where it is establishing its great arsenal, proposes to use compressed air entirely as its power. The air is compressed entirely by water power, and the pipes for this air are to be laid to all the works all over the island.

Q. Don't you think, General, that the day is not far distant when the great water powers of the country and in the mountains will be economized, for the purpose of compressing air to be carried into the cities?

A. That thing has been proposed. I think it is possible.

Q. I think it will be done. It is one of those problems which will be solved.

A. There is no impossibility in connection with it.

Q. There are millions and millions of horsepower running to waste. Now, General, I want to ask you a few questions about the quantity of water in the Comstock

lode. You state in your report that you had arrived at the cost of pumping on the Comstock by taking the estimates of superintendents over there and averaging them. But, to be more accurate, I will read what you state about it:

"By reference to the statements of the superintendents, appended to this report, it will be seen that the cost of pumping for all the mines did not, probably, exceed \$150,000 for the past year, and that in some of them there was no water at all. This sum exceeds that arrived at by the commission—viz, \$124,674—which was obtained by taking the costs as given for the mines, so far as reported, and estimating for the others."

You state here distinctly that you have taken the figures furnished by the superintendents, and have based your calculations upon them?

A. That calculation of \$124,000 is based upon the information received from certain superintendents of what professes to be their actual expenditure for pumping for one year. For the other mines we got as near as we could the relative quantity of water, and by giving a proportional sum as the cost for those mines from which we got no report, we deducted that \$124,000 as an approximation.

Q. Do you think, General, or do you know, that there had been some very dry seasons preceding the summer you were over there?

A. It was stated to us that there had been two or three very dry seasons.

Q. General Day states, in his report about the water power in Carson river, that the monthly average of the flow in Carson river, with a rate of 4 miles per hour, was $508\frac{33}{100}$ square feet; and then he goes on to state for the months of August, September, and October:

"Up to the present time the flow has been only 25 cubic feet, on a grade of ten feet to a mile."

That is during the time you were there last year—1871; consequently the flow of water in the river was one-twentieth only of what it usually was. Hadn't the river gone down to a very low stage when you were there?

A. It had.

Q. So much so that the mills had to stop?

A. In part.

Q. Well, didn't you observe that the whole country was parched, and even springs were dried up which were reported to have flowed always?

A. The country certainly had a parched appearance, and I have no reason to doubt that it was much dryer than the average at that particular season of the year. I couldn't give a more definite answer, however.

Q. You would consider that there was a great deal less water at that time than there would be ordinarily?

A. Certainly; less than the average. It was stated to us by the superintendent of the Rocky Point mill, that the day we were there the water had reached the lowest stage of the year before, and that he didn't anticipate any particular fall below the point which it had reached, during the remainder of the year.

Q. Where does the water come from which you find in going down into the earth?

A. It comes from the melting of the snows.

Q. And rains?

A. Yes, from what rains they have, but mostly from the melting of snows.

Q. In other words, you find that the water which is found in penetrating the crust of the earth is derived from the surface?

A. All comes down from the surface.

Q. Is there any limit to the depth that that water would penetrate? Would it get any further than where it is converted into steam?

A. No.

Q. Wouldn't that be a limit?

A. That would be a limit, if it would reach that point.

Q. The water would penetrate down in the crust of the earth to a great depth, and the point at which it would be converted into steam would be the limit?

A. I cannot say that it might not penetrate as far, but I don't believe it does.

Q. Where do you think hot springs come from? Don't

you think they come from that depth where water is converted into steam?

A. I haven't any very well-defined opinion on that subject.

Q. Water boils at 212° ?

A. Fahrenheit.

Q. In some places it boils at less?

A. That depends upon the pressure of the atmosphere, of course. It will boil at less at Virginia City.

Q. But lower down in the earth it will probably take—

A. At the level of the sea it would be 212° ?

Q. But at the depth of three miles in the earth it would take more degrees to boil water than on the top of the mountain?

A. I should question it very much.

Q. If you were to go down a mile into the earth it would take 230° or 240 degrees to boil water. If you go on the top of a mountain it will boil at 180° . It depends upon the density of the atmosphere.

A. If the atmosphere continued down to that point it would undoubtedly be as you say.

Q. Well, now, the source of water being melting of snows and rain, would there not be a great deal less water at the end of two or three dry seasons than there would be after a wet season?

A. I should certainly suppose so.

Q. How many deep shafts are there in the Comstock lode—very deep ones? Let me commence at one end, the shafts running down over 800 feet. There's the Ophir?

A. Yes.

Q. Next the Virginia Consolidated?

A. That is down about 500 feet. It is going down.

Q. Next is the Gould and Curry?

A. Down 1,300 or 1,400 feet.

Q. Then there is the Savage?

A. That's a deep one also.

Q. The Hale and Norcross?

A. Yes, deep.

Q. Then the Chollar Potosi?

A. That is stopped.

Q. It's down 1,200 feet?

A. Yes; it's filled with water.

Q. Then there comes the Bullion?

A. That's a deep shaft.

Q. Next is the Empire and Imperial?

A. Yes, sir.

Q. Next is the Yellow Jacket?

A. Deep; yes, sir.

Q. Next is the Crown Point? These are deep shafts that I am talking about?

A. Yes, the Crown Point and the Kentuck.

Q. Next is the Belcher?

A. There's the Belcher.

Q. And the Overman?

A. Yes, sir. In the Chollar Potosi they carried down their shaft until they gave up all idea of going down farther. They are working entirely upon the upper levels. They fancied that the two walls of the fissure came together where they were. They don't propose to go any farther.

Q. Why don't they, General?

A. I was so informed by the superintendent. He believes that the eastern and western walls of the fissure have come together at that point, and he don't think there is any use of pursuing it farther.

Q. He did believe so; but do you think he believes so now, after this strike at the Savage?

A. I don't know, but it would take a good deal to move him.

Q. Don't you think it would move him to think his neighbor had found pretty rich ore far down?

A. He is a man that it would take a good deal to move in his opinion.

Q. General, we were shown some figures here a few evenings ago in regard to the quantity of water in the Ophir mine. On page 30, Mr. Day states that in June, 1870, he had 18 inches of water, which came down in May,

1871, to 7 inches; and he says the flow of water, September 10, 1871, was 5 inches.

A. That is a diminution of 2 inches between May and September 10.

Q. When you were there, General, were they not sinking the Ophir shaft in country rock?

A. They were.

Q. Outside of the vein?

A. Yes, sir.

Q. In sinking a shaft, then, and going into the vein from a drift, do they not cut the great bodies of water in piercing the clay of the vein.

A. They sometimes do, and that is the source of their water.

Q. Well, now, in the Ophir shaft they had extended a drift at the 700-foot level into the vein. He states that in his report. When they cut that drift into the vein and cut through the clay, they tapped an increased body of water, which kept them pumping for some time. Would you consider that 5 inches which he gives here is a fair average of the water in that mine?

A. I consider that the flow of water on September 10 was 5 inches.

Q. But after they had been pumping for a long time, as he states himself, they had come down from 18 inches to 7. In going down 1,300 or 1,400 feet and cutting into the vein again, wouldn't you consider it probable that they would get another large body of water?

A. I should consider it very possible.

Q. Wouldn't you consider it very probable?

A. Well, I don't think I would be justified in saying that. I think it likely enough.

Q. Do you know how many gallons 5 miner's inches of water make?

A. I don't know; but I can calculate it.

Q. We will assume that this rule is correct, which is put down by the mining engineers, and taken as a basis of their calculations.

A. It is a well-recognized authority.

Q. I will repeat it. The rule which is given is as follows:

"A miner's inch is a body of water 336 feet long and one inch square, which passes through an orifice one inch square, under a pressure of six inches, measured from the centre, of the orifice, per minute——"

——or $145\frac{86}{100}$ lbs., or 174,054 United States standard gallons, or 20,333 cubic feet.

A. By multiplying the cubic feet by $7\frac{1}{2}$ you will get it very near.

Mr. SUNDERLAND. I have never seen any miner's measurement on the Comstock.

A. They have what they call the miner's measurement.

Q. I know it; but I have never seen it.

A. All water is sold by the Water company at that.

Mr. SUTRO. Mr. Day states that these are miner's inches very distinctly. Isn't this the rule? There are $17\frac{4}{10}$ gallons per minute. The Imperial gallon is stated in the books at $8\frac{34}{100}$ lbs. That 5 inches in the Ophir mine give 87 gallons per minute, or 5,220 gallons per hour, or 125,280 in 24 hours, equal to 944,835 lbs., equal to $472\frac{41}{100}$ tons; 472 tons of water for every 24 hours.

A. That is all a matter of calculation.

Q. Those figures I submit are correct; 472 tons of water in the Ophir mine two months after you were there, at the very end of these dry seasons.

A. That is September 10.

Q. Yes, September 10. The average of his statement from June, 1870, to June, 1871, gives 1,005 tons of water for every 24 hours in the year. The greatest amount of water which was taken out in June, 1870, 18 inches, is equal to 1,700 tons a day. That's the Ophir mine. In the Gould and Curry mine the water is stated at 3,500 gallons, equal to 350 tons per day. Now, we have two deep shafts here that will give us an average, taking the lowest stage at the end of these dry seasons, at 411 tons for every 24 hours. Now, would you consider that every thousand feet in length of the Comstock lode would give almost a similar average of 411 tons?

A. I should think that would be beyond the average. Some of the mines are entirely dry.

Q. Which ones?

A. The Bullion.

Q. That is only one. What others?

A. The Yellow Jacket has very little. The Crown Point.

Q. I beg your pardon; doesn't the water from the Yellow Jacket flow into the Crown Point?

A. One is doing the pumping for the other, and for the Kentuck also.

Q. The Crown Point is doing the pumping. They had the deepest shaft when you were there?

A. Well, perhaps so.

Q. You say the Crown Point don't pump a great deal?

A. Very little.

Q. Now, allow me to call your attention to a telegram. You see the evidences of the wet season are already showing themselves: in January we had a good deal of rain out there. The superintendent of the Crown Point telegraphed on the 7th of January to the San Francisco office:

"On the 1,300 level nothing is being done, and nothing will be done until the water is drained off, which will probably take three weeks."

Here is a statement made in the DAILY STOCK REPORT of February 19, 1872, the very latest paper that has arrived here:

"BELCHER MINE.—The north winze is down 25 feet below 1,200-foot level, and they have struck water, and been compelled to suspend working it."

That is in the Belcher mine?

A. Yes.

Q. When you were over there, was there much water in the Savage mine?

A. Yes.

Q. Were they not drowned out both there and in the Hale and Norcross?

A. They were.

Q. Now, taking all these facts into consideration, and arriving at a fair average in the quantity of water, would

you consider 411 tons too high an estimate for an ordinary year for every thousand feet on the lode?

A. I couldn't give an answer to the question in the shape in which it is put at all, because I do not accept that number of tons. I should require to figure it in order to give an answer.

Q. General, supposing that the 411 tons are correct—the average between the Ophir mine and the Gould and Curry—would you consider that too high an estimate as an average for every thousand feet upon the lode?

A. As the mines existed when we were there, I should consider it too high an average.

Q. If you were to take the average of wet and dry seasons, would you consider that too high?

A. I cannot take the average of a matter with which I am not acquainted. All I know in reference to the mines, so far as regards their wetness or dryness, is from what I saw of them while we were there and from what has been stated by the superintendents in their reports.

Q. Then, taking the time that you were over there, what would you consider at the time a fair average for every thousand feet on the Comstock lode, taking it to be correct that the average between the Gould and Curry and the Ophir was 411 tons?

A. I am not prepared to answer the question.

Q. You can't answer that question any more absolutely than you did by taking as a basis the statements of these superintendents and averaging from these?

A. I can, because we got that up at the time.

Q. You say you have estimated for the others?

A. Estimated for the others in the shape of cost.

Q. Now, I want you to estimate, as far as you can, the proportion for every thousand feet of the Comstock lode, taking as a basis the average which I have here given between the Ophir mine and the Gould and Curry mine of 411 tons a day.

A. It would take me some time to make the calculation

before I can answer the question. I would prefer to bring it here to-morrow, but I could do it this evening.

Q. Well, make a fair average.

A. I shall make no average without a calculation.

Mr. SUNDERLAND. Bring it in to-morrow.

Mr. WRIGHT. I will take the cost. That is the only way in which I can arrive at it. I must take the sum of the two amounts that were pumped from these mines, and the cost of pumping in that way.

Mr. SUTRO. In that case you would take for granted as correct what these superintendents stated to you?

Mr. WRIGHT. Most undoubtedly I should.

Q. I don't believe those statements have been fully given to you. I don't believe they have been given in a manner to enable you to arrive at a correct conclusion. Now, I want to get your general opinion as to the quantity of water that will probably be encountered on the whole Comstock lode, taking every thousand feet from one end of the lode to the other, and taking as a basis the two mines here. It is only an indefinite opinion.

A. I can give no indefinite answer. I have no opinion about it at all.

Q. Would you consider it more likely that they would have more water at the Gould and Curry mine than at the Chollar Potosi mine at the same depth?

A. I have no reason to suppose so.

Q. Have you any more reason to suppose that they would have any more water there than at the Crown Point?

A. I think they had. That is the answer to the question.

Q. How much more at that time?

A. The answer is very indefinite, but I think three times as much. I don't attach any value to it.

Q. It is simply a matter of opinion. We have the statements of two of these mines—the Crown Point and the Belcher—drowned out by water.

Mr. SUNDERLAND. I don't know where it comes from.

Mr. SUTRO. I have just read a telegram. It is stated by the superintendents.

Mr. SUNDERLAND. It may run into the top of the shaft.

Mr. SUTRO. No, sir. It says:

"The north winze is down 25 feet below the 1,200-foot level, and they have struck water, and been compelled to suspend working it."

Mr. SUNDERLAND. I have got an account from the Savage, which was drowned out when the General was there, that they had got to carry water 1,400 or 1,500 feet to assist them in blasting.

Mr. SUTRO. How much water did they have in the Savage while you were there, General Wright? Were they drowned out?

Mr. WRIGHT. For a time they were.

Q. You didn't go down?

A. No, we did not.

Q. They refused to let you go down?

A. No, not absolutely refused.

Q. But they threw obstacles in the way?

A. They were pumping there as hard as they could.

Q. They didn't want to show you the mine?

A. I don't think that was it. I had no reason, at least, to think so. They had struck one of these pockets, and they were pumping with all their power.

Q. Supposing there were 22 deep shafts down this lode at every thousand feet, what would be the average?

A. I haven't the information which would enable me to answer the question.

Q. Well, if the Comstock lode is going to be worked, they will have to have a great number of shafts down?

A. I would say that as a general rule the water decreased from the Ophir mine to the Divide, and increased from the Divide to the Overman. The mines that are near the Divide—the Bullion, for instance—would be absolutely dry.

Q. Well, then, taking that as a basis, wouldn't it be about a fair average to take say 25 per cent. less than what is stated?

A. I couldn't answer that question. I have no data with reference to it whatever. I have nothing on which to found an opinion.

Q. That is very important.

A. That may be; but I cannot answer a question upon which I have no information, and it is too important a question to be simply guessed at.

Q. Supposing there were bore-holes let down from these shafts, after the tunnel be finished and connections made, would that water not run off?

A. Certainly.

Q. Taking 472 tons in the Ophir mine as an average for other mines, would it not be an immense saving to the mine-owners to have the water let off below?

A. It would be a saving.

Q. Wouldn't it save all the cost of pumping that water?

A. It would save just the cost of pumping the water.

Mr. SUNDERLAND. Less the value of the water when pumped?

A. Yes, less the value of the water when pumped.

Mr. SUTRO. Wouldn't it save a good deal else besides pumping, by avoiding the difficulties of working in water?

A. Something, probably; but I saw no material difficulties occasioned by the water in the working of the mines. The water was generally pumped out with great ease by the machinery they had.

Q. Here is a statement by the present superintendent of the Ophir mine at Virginia City. He gives the cost of pumping for the month of January, 1872, at \$2,483 26, and then he estimates the indirect cost of the raising of water for the month of January at \$3,000.

Mr. SUNDERLAND. I object to that statement being considered as evidence.

Mr. SUTRO. Have you any doubt that it is a statement made by the superintendent of the Ophir mine?

Mr. SUNDERLAND. I doubt very much the correctness of that statement.

Mr. SUTRO. It isn't a question of the correctness of it now; it is a question whether it is a statement of the superintendent of the Ophir company; and if it be so, it is as good as any statement we have had introduced here.

Mr. SUNDERLAND. Not at all.

Mr. SUTRO. Supposing this statement to be correct, General Wright, that it costs \$3,000 per month, in addition to the actual cost to the company, in which is included all the cost of pumping, wouldn't that alter your figures very considerably?

Mr. WRIGHT. I cannot say that it would. The total cost for pumping for twelve months was nearly \$30,000, or \$29,307 04. Now, it is very well known that the amount of water in one month differs from that in another. I don't think there is anything there which would enable me to form any opinion of the annual cost of pumping for the mine. If that is to be taken as an average for each month; if the cost as stated there for pumping for the month of January were to obtain for all the months, it certainly would change my opinion.

Q. Wouldn't it change all these figures if, besides the cost of pumping, we take the outside cost, and add that to the cost?

A. In answer to that, I would say, that I understand this outside cost to be embraced in what is given by the superintendent of the Ophir company.

Q. Well, I will read this whole statement here, in order to get at my idea. He states :

" Cost of pumping for month of January, 1872:

Pitman's wages.....	\$170 50
One-half of engineer's wages.....	311 00
One-half of fireman's wages.....	124 00
Three-quarters of wood-hauler's wages.....	93 00
Three-quarters amount of wood consumed.....	1,410 00
One-half of oil and tallow.....	11 25
Interest on cost of pumping machinery, \$36,351, at one per cent. per month.....	363 51
Total.....	2,483 26
Total cost of water furnished water company	600 00
Leaving net cost for January	1,883 26

The indirect cost of raising water for the month of January is estimated at \$3,000."

Mr. SUNDERLAND. What does the indirect cost consist of?

Mr. SUTRO. He doesn't state. The indirect cost he states is \$3,000.

Mr. SUNDERLAND. I object to that.

Mr. SUTRO. Well, it don't matter if you do object. Supposing this to be correct, General, would it not very materially alter your figures on the whole Comstock lode: this cost of \$1,883 26, and the indirect expenses of \$3,000 in addition?

Mr. WRIGHT. In answer to your question I will state, that the details given there are essentially the same as those given here. (Appendix to Report.) That \$3,000 is certainly not to be added to the \$1,883 26.

Mr. SUTRO. I say that I must understand that that \$3,000 is to be added to the statement given here.

Mr. SUNDERLAND. You don't suppose that statement to be correct, General?

Mr. WRIGHT. He has taken the cost of three-fourths of the wages, and so on down, the same items that are given here. He has deducted from that the value of the water sold, and he gets a certain result, which we have here, as the net cost of raising water for one year, \$20,342. Now, he puts on for the month of January \$3,000 more, that certainly is not included in this. I don't profess to understand it.

Mr. SUNDERLAND. Nobody else.

Mr. WRIGHT. But, if that be correct, it should be added to the \$1,883 26, and it would certainly influence the estimate of cost of pumping on the Comstock lode.

Mr. SUTRO. Do you think, General, that the mines on the Comstock lode are managed entirely in the interest of the stockholders?

Mr. WRIGHT. I have no certain means of knowing. That was not a part of the investigation with which we were charged.

Q. What do you know, from common report?

A. I would like to ask the committee if that is a fair question. I very much dislike to answer questions of that nature.

Q. It is probably disagreeable to you to answer that question, but at the same time it is important, in view of this investigation, to know whether those mines are managed as some banking institutions would be in the Eastern States, or reliable corporations, for the benefit of the stockholders. I want to understand whether it is so, or whether they manage them for the benefit of certain parties who have the control. You can only speak by general report, and I want you to say what you have heard. You know what everybody there is talking about.

A. Well, if that is a question that the committee desire answered, of course I will answer it.

Mr. SESSIONS. The committee has been very liberal with both sides, and allowed about such questions to be asked as the parties in controversy have wished.

Mr. SUNDERLAND. I have been objecting so long, that I don't propose to object to anything hereafter.

Mr. SESSIONS. Both sides have asked questions of a similar character.

Mr. SUTRO. I would ask, Mr. Chairman, that General Wright be permitted to answer that question from his general knowledge or common report.

Mr. SESSIONS. If he has heard these things by common report, and is disposed to answer, he can do so.

Mr. SUNDERLAND. I am not afraid of any inquiry that can be instituted.

Mr. SUTRO. I will read from the ALTA CALIFORNIA of February 15, and make that my question.

Mr. WRIGHT. I can answer the question if it is desired. I simply want the authority of the committee. It is putting me in a false position, unless I am required by the committee to answer.

Mr. SESSIONS. We don't require it.

Mr. WRIGHT. Or if it is desirable, or anything else, that will take the responsibility off of me of willingly giving what I have heard. I have no objection to answering the question at all, other than I would like to have the responsibility of it taken from my shoulders.

Mr. SHOBER. I don't understand that the committee would demand an answer; but the investigation thus far has been characterized by a great deal of latitude.

Mr. WRIGHT. If it is in any way desired by the committee, I should answer it without any hesitation.

Mr. SUTRO. I should desire that the question be answered. Questions have been answered like it a dozen times already.

Mr. SUNDERLAND. They have always been propounded by Mr. Sutro.

Mr. SUTRO. Mr. Sunderland has proposed similar questions before.

Mr. SUNDERLAND. Never.

Mr. SUTRO. Well, I would ask, Mr. Chairman, whether there is any objection by the committee?

Mr. SUNDERLAND. I don't object.

Mr. SESSIONS. I don't see that there is any objection.

Mr. WRIGHT. I didn't talk with people enough to get the ideas of the majority.

Mr. SUTRO. Well, what is your opinion of the opinion of the people with whom you talked?

Mr. SESSIONS. What would be regarded as the public sentiment there, the general conviction of the people?

Mr. WRIGHT. I think the general opinion, so far as I had occasion to ascertain, is, that the mines are not managed exclusively in the interests of the stockholders. I do not give that as my opinion. I have no opinion about it.

Mr. SUTRO. But you heard people talking about it; that is the general opinion. Now, let me read an extract from the daily ALTA CALIFORNIA (one of the leading papers of the Pacific coast) of February 15, 1872:

"As matters stand at present, there is no safety whatever for the stockholder. He is completely at the mercy of his board of trustees. It has come to be regarded as a rule, that he has no rights whatever which they are bound to respect. Out of the multitude of instances which might be adduced, for the purpose of illustrating this curious and by no means satisfactory condition of things, we will bring forward only one. It is often the case that a board of trustees, and the officers selected by them, sell out every share of stock which they hold, and enter into a conspiracy to break down the value of the property. The interests of the stockholders are, therefore, in the hands of their most deadly enemies. They circulate falsehoods as to the condition of

the mine; look in every direction but the right one for developments, and cover up whenever a strike is made. For the unfortunate stockholder, in such case, there is nothing left but to hold on to his stock and trust to the chapter of accidents to come out right. It has been suggested that the best method of remedying this constantly increasing evil would be, to give the stockholders the power, within certain limits, to eject an unfaithful board of trustees, and substitute at once one that would have their confidence."

MR. SUNDERLAND. That is just what we have done in the State of Nevada. Laws have been in force there for six years.

MR. SUTRO. Is that about the statement, General Wright, that is usually made over there by the people, or about the general idea which is entertained as to the management of the mines?

MR. WRIGHT. I have heard statements similar. Personally I know nothing about the matter.

MR. SESSIONS. Do the laws of your State give the stockholders authority to call a meeting?

MR. SUTRO. It is proposed by a new law that one-third can call a meeting, and two-thirds can remove the trustees any time.

MR. WRIGHT. Any or all?

MR. SUNDERLAND. It's in the laws of Nevada. In California, where the most of these companies are incorporated, there is a bill pending which has passed one branch of the legislature and will the other, to accomplish the same thing.

MR. SUTRO. Now, General Wright, I want to read from the same paper, from the ALTA CALIFORNIA, the financial and commercial report of February 15, 1872. It says:

"One of the greatest evils in mine management is the almost unlimited power of the superintendent to make or unmake the market value of a mine. This is so well understood, that where there is a disposition to work the market rather than the mine, a collusion between trustees here and a superintendent on the spot causes the profits or expenses of the mine to rise and fall exactly in accordance with the stock account of the operators. This is, of course, far from being always the case, and a considerable proportion of what the public hears of 'rings,' 'jobs,' 'collusions,' and 'conspiracies' are the mere conjectures of badly-informed or spiteful busybodies. There are gentlemen who own and control companies of perfect integrity and superior business habits—men who, although naturally desirous of acquiring as many clean dollars as possible, will reject a dirty one on any terms. They will not suffer wrong-doing if it is possible to prevent it. Nevertheless, they are themselves sometimes the dupes of the designing superintendent, who can make flattering reports, select ore, make large returns, suppress expenses, force up the price of the stock, and swindle alike the trustees and

the stockholders. On the other hand, with a superintendent of strict integrity, giving the exact condition of the mine understandingly, there would be little room for fraud. The British public have long since run through experience of every possible fraud, and have devised means of lessening them to a certain extent. Among these means is to require an entirely correct map of all the works in the mine, shaded so as to show where the ore exists, where it has been taken out, and where the mine is barren. The superintendent is then required to state every day how many men are employed, and show upon the map where each gang is at work—whether opening out ore or uselessly employed where he knows there is none. The stockholders can then see how their money is spent. If they see the men employed getting out ore with satisfactory results one day, and then see them cease working that spot and employed in a barren portion of the mine, while the receipts diminish, they understand the trouble and apply a correction. Superintendent Watt, of the Eureka, Grass Valley, has taken a step in the right direction in preparing a map of that mine for inspection of stockholders, but such a map wants to be accompanied by daily reports, indicating upon the map where on the 3,600 feet of the company's mine the ore crops out; where it has been taken out; where there are indications of ore at present, and where the 150 men employed in the mine are at work; if they are following the leads of ore; if every pick and spade is directed to the practical point of getting out ore, or whether two-thirds of the men are working where there is no reasonable chance of getting ore, to the neglect of those portions where there is value. If ore is got out, how many of the whole force employed did it; how much was sent to the mill, and how much did it yield; and let these facts be certified to by foreman and mill-man each, in his department. The Legislature should then make false statements and malfeasance on the part of those officers punishable as felony. There is no doubt but that the most satisfactory answers could be given, but we wish to point out what should be a rule in all mines for the protection of stockholders. The corporate mining on this coast involves millions of dollars of capital held by stockholders. The interest is daily taking larger proportions, and it is high time that some means were adopted to place a mining property, that may have millions of value, above the caprice of an irresponsible superintendent. The great value of ores in some of the mines makes it necessary that the men should be searched each time they come out, to see that no pieces of ore are concealed upon their persons; but a superintendent is put in control, with power to put up or down the value of the whole concern to the extent of millions, in order that he may profit by the stock fluctuations without check. The trustees who assume to manage the property of others are at common law responsible, and may be held liable for any misconduct in office; but they are themselves subject to the irresponsible action of a superintendent. There are well-managed mines, with superintendents of the highest character, and in such cases the results are satisfactory."

Mr. SUNDERLAND. The writer of that didn't get any shares when he wanted them.

Mr. SUTRO. Well, this is one of the best papers in California, and I simply read this to show what is stated at the present time in San Francisco in regard to the management of these mines. Now, General Wright, I want to ask you whether it is probable, or whether it is human nature, that these superintendents over there, who have immense chances of making money, would tell all the facts

that are favorable to an enterprise which would, to some extent, interfere with their operations?

Mr. WRIGHT. I presume it is the duty of the superintendent to report to the trustees or the managers of the company.

Q. I mean, do you think it is human nature, where a man who has got a chance to make a large fortune——

Mr. SUNDERLAND. I object to that question. If Mr. Sutro wants to know anything about these trustees on the Comstock, let him ask so.

Mr. SUTRO. I am naming no one. I am asking the general opinion.

Mr. SUNDERLAND. Well, we may understand human nature as well as the General. I object to the question.

Mr. SUTRO. General, is it likely that men who are placed in a position where they are making large fortunes in speculations in stocks and otherwise would be very apt to give testimony which would go against their interests and introduce a new system of mining?

Mr. WRIGHT. Well, I don't think men are generally very apt to give information which isn't to their interest.

Q. That is all about that. Now, I want to read another extract from a paper. These things have all got into the newspapers. They say that "when thieves fall out, the facts come out." They have been keeping these things out of the papers, but now they are getting in.

Mr. SUNDERLAND. Are all the newspapers from the Pacific coast to be introduced as evidence?

Mr. SUTRO. No, I am only going to introduce two or three.

Mr. SESSIONS. Are the articles very lengthy?

Mr. SUTRO. No, sir. I will read from the San Francisco CHRONICLE of February 16, 1872:

"MINING STOCKS.—HOW THE MILL RING GOT CONTROL OF THE MINES."

(That's the Bank of California.)

Mr. SUNDERLAND. I object to that, if the chairman please. This popular clamor that has been made here the last four

or five years against the Bank of California, I think, is beneath the dignity of the committee to consider. A great deal of capital has been made out of it, I know. Now, I don't know that the Bank of California or any of its officers ever stole anything, and I don't know that they ever stole anything belonging to Mr. Sutro. I think they are honorable men; and I think that this bringing the Bank of California, its agents or officers, in every time Mr. Sutro has a chance, is an outside question wholly, and ought not to be permitted at all. We have heard it every time we have had a meeting.

Mr. SUTRO. Mr. Chairman, I wish to submit, that it is very important that all the facts in connection with the opposition of the Bank of California to this work should be known. It is a notorious fact that the Bank of California, by its agents and by its influence, has been trying to upset a work which has been authorized by act of Congress. They come here to Washington, and Mr. Sunderland, as their agent, comes here to Washington, to oppose any aid from the Government to this work. The Bank of California don't want this work carried out. They want to break it up with us, and get it for themselves. That's the whole secret of it; and I think it is pertinent, or important, in this examination here, which is not only for the purpose of getting at the facts in regard to the construction of that tunnel, but also in regard to the working of these mines and the management of them, that we should arrive at as correct an opinion about the whole subject as we can possibly; and therefore I would ask that I be permitted to read a statement here from a paper. I am not going back for years, but I take a statement that is not two weeks old, and that concerns the management of the mines at the present moment. I wish to read that statement, and ask General Wright whether he heard anything of that kind when he was over there. It will only be taken for what it is worth. It is not evidence, any further than a newspaper statement. General Wright's an-

swer will also be simply his opinion as to what he heard during his sojourn in Nevada.

Mr. SESSIONS. I don't think it is necessary, Mr. Sutro, to spend much time on this. If the Bank of California is throwing up obstacles against this enterprise, it would be well to prove it; but I don't see that it is proper to read the newspapers.

Mr. SUNDERLAND. If it is desirable for the committee to hear anything, I shall not object. I withdraw my objection, if the committee choose to hear it.

Mr. SUTRO. I will simply read these two articles. I will agree not to introduce anything else from the newspapers. I look upon it as important.

Mr. SESSIONS. I don't see how it will be material, Mr. Sutro.

Mr. SUTRO. There has been a fight over this matter here. There has been a statement put in here that the Bank of California owns those mining stocks, and I mean to show that it don't. They have been robbing the public, and I want to show, by reading these newspapers, that it is common report out there.

Mr. SUNDERLAND. Supposing it is all true, what has it got to do with the tunnel?

Mr. SUTRO. It's very important. Those men want to keep up this fleecing of the country, and it isn't for the interests of the people or the Government for this thing to go on.

Mr. SHOBER. It may be well enough to show, if it could be done, by competent evidence; that there is opposition to this tunnel from such a source. But whether the reading of extracts of that character accomplishes the object, I doubt. We have allowed great latitude heretofore, but if Mr. Sunderland objects, I should certainly sustain the objection.

Mr. SUNDERLAND. Well, I do not. I won't object to anything hereafter.

Mr. SESSIONS. If it is not very long, we will have it read.

Mr. SUTRO. Mr. Chairman, you have allowed very considerable scope on both sides. Mr. Sunderland has read from all kinds of books and papers, and I should think I ought to be allowed to do the same thing. I want to get General Wright's opinion in regard to what is general report out there. I want to read a newspaper article, and base some questions upon it. It is from the SAN FRANCISCO CHRONICLE of February 16, 1872:

"MINING STOCKS—HOW THE "MILL RING" GOT CONTROL OF THE MINES—
ELECTION OF TRUSTEES BY NON-OWNERS OF STOCK—MINES AND THEIR
MISMANAGEMENT.

"Oh, poverty of earth!
That men do deeds that win them evil names,
And shun the names, but not the deeds that win
them."

Mr. SESSIONS. Well, that's Shakspeare.

Mr. SUTRO. Yes; it's a better thing than you thought for.

Mr. SHOBER. We won't object to Shakspeare.

Mr. SUTRO—

"The truth and power of the sentiment of the above quotation was never more forcibly illustrated than in the case of those persons who have succeeded in acquiring ill-gotten wealth, at the expense of those whose interests were intrusted to their keeping, and upon whose substance they grew sleek and fat. They were quite willing to clutch at that to which they had no right, either legal or equitable, but now, when the moral responsibility of their own deeds is forced upon them, they shrink from their merited castigation, and ask to go unwhipped of justice. They shun the names, but not the deeds that won them."

Mr. SHOBER. What is he speaking of now?

Mr. SUTRO. He is speaking of the Bank of California.

Mr. SUNDERLAND. Confine yourself to facts.

Mr. SUTRO. In my opinion he is speaking of the Bank of California.

Mr. SUNDERLAND. Well, I don't believe that is true.

Mr. SUTRO. Well, I will go on. It is a good article. It is well written—

"WHAT IS THE REMEDY FOR THE EVIL?—A contemporary thinks that much of the evil complained of in the management of the mines lies at the door of the stockholders, whose carelessness, in not attending annual elections, 'leads in a great measure to the malpractices which are doing so much to destroy confidence in a pursuit which lies at the very foundation of our prosperity.' This is undoubtedly true to a certain extent, and has done its part in creating the evil; but this carelessness would not have been productive of such disas-

trous results if it had not been fostered and encouraged by those who sought to take advantage of it. The great majority of the purchasers of mining stock are those who buy with the hope of a speedy profit, and in anticipation of a rise which will permit of their soon realizing. Very few persons desire to have stock of this kind stand in their own names, because it frequently happened that long after they had sold it, simply delivering the certificates, as is customary, they have seen their names advertised for delinquent assessments, and have found their credit injured by their being supposed to own stock which had declined in value, although, perhaps, the decline had taken place since they sold. The persons who desired to gain the control and management of the mines, without owning them, wished to have the stock stand in the names of such individuals as they could direct at the annual election, and very adroit, indeed, were the means resorted to to accomplish the object. Let us suppose, for instance, that parties, such as we have described, had control of a banking establishment, and we may judge, perhaps, how the trick was done. The first thing such a bank would do, would be to hold out inducements to brokers and persons dealing in stocks to open accounts with them, by affording facilities for the deposit of stock, bought or sold on time by their customers, but establishing a rule in the beginning that all stock so deposited must be transferred to the name of one of their own attachés, 'just to save trouble, you know.' In that manner many shares of many companies would find their way into the name of some irresponsible person as 'trustee.' Then occasionally loans would be made on stock, which, of course, was transferred to the same 'trustee.' Persons buying this stock afterward would allow it to stand without transfer, knowing that the 'trustee' would not be attached for debt, that being the only risk run by allowing stock to stand in the name of another person. Another inducement held out to allow the certificates to remain in the 'trustee's' name was, that upon certificates in that name the dividends upon Chollar, whose office was in this city, would be paid by the agency of the bank in Virginia, while those upon Yellow Jacket, whose office was in Gold Hill, could be collected here upon presentation of the certificate, while the holders of stock in less favored names were put to the expense and delay of collecting by express. So that when the day of the annual election came around, the majority of all the stock was frequently found to be in the name of the 'trustee,' whose vote was thus enabled to control the result; and, with the mines thus brought within their power, the ring which managed them acted as has been heretofore described in the CHRONICLE, and grew wealthy from the property of other people. It is not necessary now to explain how the stock deposited, as we have described, was used to depress the market, or how that upon which loans were made was sometimes sold at a high price and replaced when it had declined, owing to those very sales. Just so long as trustees of mines can be thus elected, and just so long as, when elected, they are practically superior to all law, will mining investments fail to obtain or deserve the confidence of the public. An apologist in a morning paper for mining mismanagement lays the blame of all the rascality upon the superintendents, who certainly deserve censure in many cases; but when we remember that the trustees possess the power to remove them at pleasure, it will scarcely be credited that the inferior officer is responsible for the entire wrong. Perhaps if stockholders were obliged to have stock transferred to their own names, and trustees were made criminally liable by statute for their evil doings, confidence might be measurably restored."

Now, General Wright, I have read this article in order to ask you whether, while you were over there, you heard people make statements of that kind?

Mr. WRIGHT. I have no opinion whatever upon the subject generally.

Q. You were there investigating this tunnel question. What did you hear as common report? Did you hear about such statements as are given in this article?

A. So far as my recollection serves me, not one of them.

Q. Not one of what?

A. Not one of those statements did I hear.

Q. Did you never hear over there of parties getting the control of the mines by loaning money on stock?

A. I will say in answer to that, that it was no part of the investigation with which we were charged. As a rule, we didn't converse upon the subject outside of the points laid down.

Q. You heard that the mines were not properly managed over there?

A. I heard, as I said often, in general terms, that they were not always managed in the interests of the stockholders.

Q. You didn't hear the details given here?

A. No, sir.

Q. Now, I will read another little extract, and then I will close this subject. I will read the San Francisco CHRONICLE, dated Sunday, February 18, 1872:

"STOCK SHARPS.—HOW THE MILL RING GOT THE MILLS—ASSESSMENTS TO PAY CRUSHING BILLS—THE ADVANTAGE OF BEING ON THE INSIDE.

"'Let not the buyer rejoice, nor the seller mourn; for wrath is upon all the multitude thereof.'—Ezekiel, vii. 12.

"Many very excellent persons have objected to the publication of newspapers upon Sunday, but perhaps if writers for the press would make it a rule to prefix their articles with a scriptural quotation, as we have done in this instance, much of the objection alluded to would be avoided, for the careless reader would oftentimes have his thoughts thus directed into a channel befitting the sanctity of the occasion. The text we have chosen is particularly applicable to those who deal in mining stocks, and the readers of the CHRONICLE will understand us when we tell them that wrath is upon such dealers; and if they do not believe it, let them wait a little while until the market collapses, and they will acknowledge the correctness of the proposition. For when that time comes, the buyers at the prices of to-day will assuredly not rejoice, neither will the sellers mourn, and our text and our warning will be fulfilled.

"But we wish to have it distinctly understood that, in warning the people against dealing in mining stocks, we do not mean to say that the mines are not good, nor that much profit may not be derived from working them, but

only to show that, in the way they have been and are managed, there is no safety whatever in meddling with or investing money in them. Mining is a business in which, when profitable, the profits are very large; but in proportion as such is the case are the chances of loss; as a man or a company may spend much money in opening a mine and get nothing, while his neighbor may almost immediately acquire a fortune. When the Ophir was first started, the shaft was sunk in pay rock, and there was no assessment. For several years, and until the first deposit found was worked out, and nothing of any consequence had been discovered since, while on the ground immediately adjoining nothing has ever been found, and yet the adjoining claims at one time sold for as much as Ophir. What we want to make plain is, that with a 'square deal' there is quite as much excitement and risk about mining as is necessary to make it pleasant; but when you know you are playing against a 'hogging game,' it becomes monotonous."

Mr. WRIGHT. What sort of a game is that?

Mr. SUTRO. Hogging game.

"We have endeavored, by showing how badly the Washoe mines have been managed, to convince our readers that it is better to wait until a change can be effected before trusting their money to the vortex. Having already explained how the 'mill ring' managed to control the mines, the next step in our history is to show how they got the mills. Along in 1864 the mills in the neighborhood of the Comstock lode were owned by various parties, some of whom made money, but the most of them did not, owing to the high cost of machinery and supplies and the extravagant manner in which business of all kinds was conducted. About this time the 'ring' we have described had managed, as has been related, to get the mines under their control, and they were dividing the profits of crushing the ore with some favored mill men. But this was entirely too slow a process to meet their ambitious views, and so they set about organizing title to the mills themselves. A mill man, applying to the ring managers of the mines for ore to crush, would be told that, as not much ore was being taken out, he must be content with little, but meanwhile he could be accommodated with a loan, should he require cash, which loan could be easily repaid out of the profits of future crushing, which he would be sure to get, as, of course, his creditors would feel an interest in his financial welfare. Of course the bait was eagerly swallowed, and the deluded mill man signed his own death warrant with his first note; for no sooner was he involved beyond his means to pay, when 'the bank required the money,' and he was forced to give up his property for, in many instances, less than one-fifth of its actual value. Thus, one by one, nearly all the best mills in the country fell into the hands of the cormorants, who were enabled to keep them running upon rock taken from the mines under their control, the object, of course, being to keep the stamps going, regardless of the value of the ore to be worked, and so, if no good rock was to be had, anything else that came first was sent—the mill would crush waste as well as the richest ore, and one paid as much as the other to those who crushed it. It sometimes happened, of course, that this business brought the mines into debt, and then the trustees would levy an assessment to pay the bill. When good ore was coming from the mines, it would sometimes be mixed with waste, so as to make three tons of ore. Suppose a mine was yielding rock that would work \$75 per ton—one ton of it and two tons of waste would be hauled to the mill, which would thus receive \$39 (three tons at \$13) for doing that which should have cost the company but \$6. It is easy enough to see how the 'mill ring' grew rich and powerful off of this sort of thing, and not at all difficult to understand how so many people who put their money into mining stocks lost it. About \$7 per ton was the profit (?) on each ton of ore worked by the 'ring,' and as about 1,000 tons per day were worked for some five or six years, any one tolerably well up in arith-

metic may figure up the profits on the one side and the losses on the other. And there was another way in which they made much money, and that was in 'tailings,' for the object being to work rapidly, of course the work was not thorough, and mud that would, under a more careful process, have gone to the stockholders as bullion, remained as mill perquisites in the shape of 'tailings,' which were afterwards worked at large profits. And, in course of time, the 'mill ring' grew rich and powerful, for they controlled all the mines that were considered worth controlling, owned all the mills that were worth owning, as well as all the courts and the country generally, and if any man dared say his soul was his own, he was forthwith ruined in his fortune and run out of the country. And for all this the good, easy people of San Francisco paid their assessments and lost the money they invested in mining stocks; and if they continue to invest before some change in the mode of management is brought about, the same result will again follow."

Now, I want to ask you, General Wright, whether you heard of ores mixed with rock being sent to the mill, or a very low grade of ore that didn't pay for mining?

A. I have heard of good ore being mixed with poor ore and sent to the mills.

Q. Ore that wouldn't pay by itself?

A. Ore that probably wouldn't pay by itself. That is the information that I got. But I know nothing about it; I don't know how reliable the statements were.

Q. Did you get it from one of the prominent men connected with the mines?

A. Not any managing man, that I know of.

Q. Was it an owner of the mine?

A. Yes, he was reputed to be an owner in a mine.

Q. And he said that that was a practice?

A. No; I won't state that it was a practice, but that it had been done.

Q. That they mixed in low-grade ores, that didn't pay for mining, with good ore, in order to make up a great number of tons?

A. I understand it was for the benefit of the mills. They got so much a ton for reducing the ore. They were obliged to return 65 per cent. of the assay value of the ore. If they could take a ton that would assay \$50, and mix it with a ton that was worth \$10, the sum of the two values was \$60, or \$30 a ton.

Q. Well, then, General Wright, if a man didn't own the mine, but did own the mill, this operation would accrue to

his benefit, wouldn't it, while the mine owner would be the loser?

A. Undoubtedly.

Q. And if they didn't own the mine, it would come out of the stockholders in assessments?

A. It would be so much loss to the mine. In the case which I have stated, they would reduce the \$50 ore at a cost of \$12 a ton, returning the 65 per cent. of that amount to the miners; in the case of mixing, there would be a charge of \$24.

Q. Now, I want to ask you one single question here, General. Do not these mills get the tailings which are left from working the ore? Do they not claim the tailings as their property?

A. My impression is, that, as a rule, they do. I have heard of instances, however, where the tailings belonged to the owners of the mine.

Q. Does the Union Mill Company keep the tailings?

A. I suppose so.

Q. Don't the Bank of California control that company?

A. I don't know.

Q. Who is at the head of it?

A. The agent of the Bank of California.

Q. Well, isn't it very important for the Union Mill Company to get all the ore they can, whether it pays or not?

A. All up to the working capacity of their mills undoubtedly.

Q. Well, then, if these same parties control the mines, isn't it in their power to send bed rock or country rock to these mills, and get \$12 a ton for working it?

A. It seems so.

Q. If they don't work up to the standard of 65 per cent., the mining companies are to be the judges, are they not?

A. Undoubtedly.

Q. And these mining companies are controlled also, to a large extent, by the same parties?

A. To some extent, certainly.

Q. And what remains over 65 per cent. these mills get and keep?

A. No, I don't so understand it. They are obliged to return all that they obtain, but must return 65 per cent.

Q. Well, do they ever return over 65 per cent.?

A. They say they do.

Q. Does the Union Mill and Mining Company?

A. That I cannot answer.

Q. Is it not natural that men owning mills there, and having the whole sway and swing of things, would oppose the construction of a work which would materially and radically change the mode of working the mines and the mills?

A. It would be natural that they should oppose anything which they would think in opposition to their own interests.

Q. And their interest is to keep up the present system of working the mines and its mills against the tunnel?

A. I think they say so, without exception.

Q. Well, are not the laboring men over there in favor of the tunnel?

A. I should think, as a rule, they are.

Q. Have you heard a single laboring man over there, a miner, a working miner, say anything against that tunnel?

A. I heard some of them say they felt no particular interest in it one way or another.

Q. Have you heard of any one opposing it?

A. I cannot say that I have.

Q. Did Mr. Sharon, in his intercourse with you, express any violent opposition to the tunnel?

A. He expressed the intention of opposing it, certainly, as being in opposition to his own interests.

Q. Did he say he was going to break it up if he could?

A. I don't think he went so far as that. He said he meant to oppose it.

Q. Now, General, let me quote here from a speech made by General Blair, of Michigan, in the House of Representatives, in which he uses the following language:

Mr. SUNDERLAND. I would like to have that whole speech taken down.

Mr. SUTRO. All right. We'll take down the whole of it. I want to ask General Wright whether that agrees with his view or experience over there. It is from a debate in Congress :

" Mr. BLAIR. The tunnel was not then begun. But when I was there I heard a very diligent discussion of the question. The gentleman whose name has been mentioned in this discussion, Mr. William Sharon, the agent of the Bank of California at the Comstock lode, took me in his buggy and carried me to his crushing mills, and showed me the line of the new railroad he was building, or rather had got the people to build for him. He took me to his mines, to the very bottom of them, showed me all about them, and told me he was determined this Sutro tunnel business should be stopped."

Then, in closing his speech, Mr. Blair said:

" Sir, this bank has waved its hand over the Comstock lode and ordered Sutro away. That is the whole of this transaction, as it seems to me."

General Wright, did you, sir, in your intercourse with Mr. Sharon, hear any similar expressions to that?

A. I heard Mr. Sharon express over and again his opposition to the tunnel project.

Q. Did he say he was going to stop it?

A. I have no recollection of his saying that.

Q. Didn't he say he would try to break it up; or didn't you arrive at that conclusion from his statement?

A. I arrived at the conclusion that he would do everything in his power to prevent the project being carried out.

Q. Do you think, then, he would try to set aside a law of Congress?

A. I certainly do; but how he was to proceed about it of course I don't know. I had some conversation with Mr. Sharon upon the subject, but I never asked him a question in reference to his views. These were rather casual expressions.

Q. He didn't consider the tunnel as to his interests?

A. He considered it opposed to his interests.

Q. And he was using every means to break it up?

A. I don't know. I presume he would use every means.

Q. Now, Mr. Sunderland, let me ask you a question right here; who sent you here?

Mr. SUNDERLAND. I decline to answer.

Q. Don't the Bank of California?

A. No, sir.

Q. Don't Mr. Sharon?

A. No, sir.

Q. Who do you telegraph to—who do you write to from here—reporting progress?

A. I will answer the question now. I am sent here by the entire Comstock, as it existed and was controlled when I went there, without exception.

Q. Who pays your expenses?

A. The whole Comstock.

Q. Who do you direct your letters to from here, and who do you report to what you are doing? Will you answer that question?

A. No, I will not.

Q. Who have you telegraphed to from Washington since you have been here, and who do you write to and report to?

A. I don't propose to be catechized.

Q. Do you report to anybody but the agent of the Bank of California?

Mr. SESSIONS. What transpires between the attorney and his employers is a privileged question.

HEARING THURSDAY, FEBRUARY 29TH.

Mr. SUTRO, (continuing examination of General Wright.) General, I think I gave you some figures last night in regard to the flow of water by what is called the miner's inch. I gave you those figures, and I asked you to look over them to see if you found them correct. What result have you arrived at?

A. My figures differ somewhat from those given me last evening.

Q. Will you be kind enough to state what you arrived at?

A. In estimating for the miner's inch, I took what I understood there to be the head of water; that is, six inches above the top of the orifice. That makes a difference of half an inch in the head.

Q. We have been in the habit of figuring from the center of the orifice six inches?

A. That is what I presumed from the difference in the figures.

Q. Well, taking your figures, what did you get?

A. I obtained a velocity of $5\frac{9}{10}$ feet per second, or 354 feet per minute as a theoretical velocity, or $2\frac{46}{100}$ cubic feet.

Q. How much was mine?

A. It was $2\frac{33}{100}$. This is a little larger, or $15\frac{1}{4}$ imperial gallons, or $18\frac{3}{10}$ standard gallons. I presume you figured on standard gallons instead of imperial. You put the wrong term to it, and I imagine it makes a discrepancy in our figures.

Q. I stated imperial gallons.

A. But this weight was standard gallons, I presume.

Q. Now, how much would that give in five inches in the Ophir mine?

A. I would wish to say before, that that is the theoretical velocity. The actual velocity is considerably less. It

is about $\frac{2}{3}$, and I would give the actual velocity as 236 feet per minute, the actual discharge as $1\frac{81}{100}$ cubic feet, or $12\frac{2}{10}$ standard gallons. That is the actual discharge. The first is theoretical only.

Q. That is put down in the rules?

A. It is put down in the rules as two-thirds of the theoretical, taking into consideration the size of the orifice.

Q. If I understand rightly, the orifice of an inch square contracts on the outer edge, and consequently you don't get a full square inch, and you have to deduct for it?

A. Yes, sir; that is the explanation.

Q. You have made a deduction of one-third?

A. One-third, exactly.

Q. Then, what you arrive at is the absolute discharge?

A. The absolute discharge, or a very close approximation to it.

Q. Now, Mr. Day, in his statement to the commissioners, gives us the lowest estimate in the Ophir mine at 5 miner's inches. How much, under your rule, as you have established it there, would that amount to per minute and hour?

A. It would amount to $50\frac{85}{100}$ imperial gallons per minute, 3,051 per hour, 73,224 in 24 hours. I have taken these in imperial gallons, because they were so given in yours.

Q. And at what weight did you figure it at a gallon?

A. Ten pounds to the gallon, which is the weight.

Q. How much would that amount to in 24 hours?

A. The weight of water in 24 hours would be $336\frac{12}{100}$ tons, of 2,000 pounds each.

Q. That makes somewhat of a difference in comparison with the figures which I made.

A. You would want to take one-third off your figures.

Q. I didn't deduct anything for loss. I calculated on a full square inch.

A. Well, that is too much.

Q. Mr. Batterman, the superintendent of the Gould and Curry mine, gives the discharge per hour at 3,500 gallons,

which would be very close to the figures you arrived at in the Ophir mine, taking his statement for September, which is the lowest.

A. Thirty-five hundred gallons per hour would be more.

Q. It would be a little more in the Gould and Curry mine.

Mr. SUNDERLAND. Does he give it at 3,500 gallons per hour?

Mr. SUTRO. Yes, sir. If you wish, I will read the statement again. From this report, on page 33:

"The cost of raising the water in this mine from a depth of 825 feet, and also running pump while sinking to 1,300 feet station, has been \$60 per day; quantity of water raised about 3,500 gallons per hour."

Then, according to this statement of Mr. Batterman's, there was somewhat more water in the Gould and Curry mine than there was in the Ophir mine at the time this statement was furnished?

Mr. WRIGHT. At the time the statement was furnished, the 10th of September, I think.

Q. Did you calculate, General Wright, how much the water amounted to in tons in the Ophir mine, taking the average of the year commencing with June, 1870, and ending the 1st of June, 1871?

A. The average was $10\frac{3}{4}$ inches.

Q. How much would that be in tons for 24 hours?

A. Seven hundred and eighty-one tons and five one-thousandths, ($781\frac{5}{1000}$).

Q. Did you make any figures on the maximum quantity, as stated by Captain Day, for that year, which is 18 inches?

A. Eighteen inches gives the weight for 24 hours at 1,318 tons.

Q. All these figures are somewhat less than what I had given. I made no allowance for any decrease in the discharge. I took the theoretical discharge as given in the rule.

A. You want to take two-thirds of that, and your figures will come very near these.

Q. Now, I want to ask you, General Wright, taking the

lowest statement here by Mr. Day—336 tons—and taking the highest statement during that year—1,381 tons for every 24 hours—what would you consider the increase would be after they tap the Comstock lode again? They were then in the country rock, and I believe you stated it is not probable that there is as much water in the country rock as there would be in tapping the vein. Would you think that the water in tapping the vein would come back again to this higher standard, as we have it here?

A. That is utterly impossible to tell.

Q. Wouldn't you think it quite likely?

A. I should think certainly that they would find more water as they go into the vein.

Q. Well, then, from the statements that we have before us here, we find that the Gould and Curry mine had the most water.

A. It would seem so, taking the two statements of the Gould and Curry and Ophir, the Gould and Curry is greater.

Q. Now, I want to ask you this question again. What would you consider, according to your general opinion about the country, a fair estimate, based upon these data, for every thousand feet on that lode, provided each thousand feet would be opened?

A. I don't think I have the data to form any estimates that would possess the slightest value.

Q. Well, I will not press that matter any further, because you have no data to go on, and you cannot arrive at any result. We have to form our own opinion.

A. No two men will get the same, probably.

Q. If you find 366 tons of water for every 24 hours after three dry seasons, which is the very lowest estimate that we have, we can arrive at some general idea what it would be, provided the whole Comstock lode be properly opened by shafts. General, do you see any difficulty in making bore-holes, as they do in the Pennsylvania oil wells, down to the tunnel?

A. None whatever.

Q. Is it not a very simple operation?

A. Certainly, with proper machinery it is.

Q. Provided that these bore-holes would be made connecting with the tunnel, wouldn't every drop of this water run out by its own flow?

A. Certainly.

Q. In the case of the Ophir company they would have saved the pumping of 781 tons of water for every 24 hours during the year. Do you know that the Ophir company has taken out any ore from their mine since they commenced work on this new shaft?

A. I understand not.

Q. Now, under the contracts, or the law under which these people owning mines on the Comstock lode pay a royalty, would these people who own the Ophir mine have had to pay anything to the tunnel company during that time?

A. That mine would not.

Q. Consequently the Ophir mine would have had the full benefit of the tunnel for drainage; and, provided they would have connected it with the tunnel, they would also have had ventilation absolutely for nothing?

A. Certainly.

Q. In your investigations on the Comstock lode have you arrived at any figures which would give us an idea how many feet out of the 22,000 of the lode are actually productive in depth—that were, when you were there, productive in depth?

A. No, I have not. It can easily be calculated.

Q. Now, supposing you go over this list. It don't matter about a few feet. We can arrive at a general idea about it. At the north end there was nothing north of the Ophir mine that was productive in depth?

A. Nothing, but on the surface.

Q. Taking the 1,000-foot level as a basis: There is the Ophir mine, which had nothing in depth. Then there comes the Consolidated Virginia: had they anything there?

A. Nothing.

Q. There are several small mines I leave out.

A. Those were mere surface workings.

Q. Did the Gould and Curry have anything in depth?

A. Nothing.

Q. Did the Savage have anything in depth at that time?

A. At the deepest point, they did not.

Q. Under the 1,000-foot level?

A. I am not prepared to say that.

Q. Did you hear anything?

A. I think not as low as 1,000 feet.

Q. Was the Hale and Norcross below the thousand feet?

A. I fancy not.

Q. Well, they may have had something down there, possibly?

A. I think not. Those are the two mines I did not go into.

Q. You at least tried to go in?

A. Well, we would have gone in, except they were pumping.

Q. The Chollar Potosi mine comes next?

A. Nothing there.

Q. Then there comes the Bullion?

A. Nothing.

Q. Then the Alpha?

A. Nothing.

Q. Then come all the Gold Hill mines—a dozen of them. Was there anything down there before you came to the Yellow Jacket?

A. Nothing.

Q. Then we have the Yellow Jacket?

A. They were finding it low down.

Q. For how many feet did the Yellow Jacket find it in length on the lode?

A. That I have forgotten.

Q. Then comes the Kentuck. Did they have anything below the 1,000-foot level?

A. That I cannot say. That is a mine I didn't go into.

Q. Then comes the Crown Point?

A. The Crown Point did.

Q. Then comes the Belcher?

A. They had just struck it when we were there.

Q. Then comes the Segregated Belcher and the Overman. Did they have anything?

A. No, sir.

Q. Then out of the 30 or 40 mines there, the Belcher, the Crown Point, the Yellow Jacket, the Hale and Norcross—

Mr. SUNDERLAND. He says that handn't anything below there.

Mr. SUTRO. Well, the General stated that he hadn't been down there. Did they state to you, General, there was nothing down there?

Mr. WRIGHT. I don't remember that they did. Their maps would have shown us, which they furnished us with.

Q. Well, that is immaterial. The Hale and Norcross probably had some ore down there.

A. They were working down; but my impression is, not as low as the 1,000-foot level. But I am not certain.

Q. Then, out of 30 or 40 mining companies, we have but three mines out of which we get ore below the 1,000-foot level?

Mr. SUNDERLAND. Who says there are 40 mining companies?

Mr. SUTRO. Well, I will take the list here, and that will show it.

Mr. SUNDERLAND. There are no 40 mining companies.

Mr. WRIGHT. I can give you what companies are actually engaged in mining. There are other companies in existence, I believe.

Mr. SUTRO. First is the Utah; one thousand feet. Did that have anything, General, in depth.

A. No deep mining.

Q. I am speaking of below the 1,000-foot level.

A. No ore.

Q. The Allen. Did they have anything?

A. No.

Mr. SUNDERLAND. But there is no such company.

Mr. SUTRO. Then comes the Sierra Nevada; 2,657 feet?

Mr. WRIGHT. No.

Q. The Union; 302 feet. Did that have anything, General?

A. Nothing.

Q. The Ophir north; 1,200 feet?

Mr. SUNDERLAND. If the chairman please, there are no such companies as these in existence. The Sierra Nevada is the only one called that has any existence. I object to Mr. Sutro making testimony here.

Mr. SUTRO. Mr. Sunderland, will you deny that there are any such mines in existence? The companies may not be in active operation now; they may have given up. Do you state here that there are no such mines as those?

Mr. SUNDERLAND. I do.

Mr. SUTRO. Well, we'll take King's report.

Mr. SUNDERLAND. Except the Utah, all those mentioned there are considered with the Sierra Nevada. They are located in front of each other, along the supposed line of the Comstock. They have gone out of existence, excepting the Utah, and there has been no working done for 7 or 8 years. They were abandoned long ago.

Mr. SUTRO. Why are they abandoned?

Mr. SUNDERLAND. Because there never was any ore in them.

Mr. SUTRO. Because it cost too much to pump out water and mine under present methods, and they haven't got the money to do it.

Mr. SUNDERLAND. The Utah is an imaginary claim up north of the Sierra Nevada. It never had a pound of ore in it in the world.

Mr. SUTRO. We have got Mr. King's report here, which is a Government report, and which you have quoted from quite frequently. We will take that as our basis now. We won't look at any map at all. Mr. King states on page 99:

"MINING CLAIMS.—The following is a list of the mining claims located on the course of the lode, as far as its continuity has been traced with any certainty. It gives the length of ground claimed for each company or individual owner, beginning at the north and proceeding towards the south: Utah, 1,000 feet; Allen, 925 feet; Sierra Nevada, 1,959 feet; Union, 500 feet."

General, will you be kind enough to state when I come to a mine that has ore below the 1,000-foot level?

A. Ore or working?

Q. One which has been mining ore; ore found below the 1,000-foot level, or working ore at the time you were over there.

"Union, 500 feet; Ophir north mine, 1,200 feet; Mexican, 100 feet; Ophir south mine, 200 feet; Central, 150 feet; California, 300 feet; Central No. 2, 100 feet; Kinney, 50 feet; White and Murphy, 210 feet; Sides, 500 feet."

I might as well state here, that from the Central No. 2, to and including the Sides, they have been consolidated into one company, now called the Virginia Consolidated. Next comes the

"Best and Belcher, 250 feet; Gould and Curry, 1,200 feet; Savage, 771 feet; Hale and Norcross, 400 feet."

A. I understand the Savage has struck ore since we came away, but when we were there it had not.

Q. We are speaking about the time these reports were made. What was your statement about the Hale and Norcross?

A. I am not positively certain of it. I didn't visit the mine.

Q. Well, supposing we count that in as having ore?

Mr. SUNDERLAND. Needn't count it in unless the General says so.

Mr. SUTRO. Well, so as to make no mistake about it, we will count it in. You are doubtful about it?

Mr. WRIGHT. I am doubtful about it. It is my impression that they found no ore below the 1,000 feet.

Mr. SUTRO. Then comes the

"Chollar Potosi, 1,434 feet; Bullion, 940 feet; Exchequer, 400 feet; Alpha, 278½ feet; Apple and Bates, 31½ feet; Imperial North, 118 feet; Bacon, 45 feet; Empire North, 55 feet; Eclipse, 30 feet; Trench, 20 feet; Empire south mine, 20 feet; Plato, 10 feet; Bowers, 20 feet; Pi-Uta, 20 feet; Winters and Küstel, 30 feet; the Consolidated, 21 feet; Rice ground, 13½ feet; Imperial south mine, 65½ feet; Challenge, 50 feet; Confidence, 130 feet; Burke and Hamilton, 40 feet; Yellow Jacket, 943 feet."

A. That mine was working.

Q. That has ore in depth?

"Kentuck, 93 $\frac{3}{4}$ feet; Crown Point, 540 feet."

A. That was working below that level.

Q. "Belcher, 940 feet; Segregated Belcher, 160 feet; Overman, 1,200 feet; North American, 2,000 feet; Baltimore American, 2,000."

Will you please to state how many feet there are in the Comstock altogether?

A. In the claims named there are 21,463 $\frac{5}{8}$ feet.

Q. Do you know how large a body of ore they were working in the Belcher mine?

A. I do not. It was not developed.

Q. The claim is 940 feet in length; but were they working for the whole length, you think?

A. The new strike had not been developed for the whole length of it at that time.

Q. In the Crown Point, do you know how long the ore body is there?

A. I have quite forgotten. I think it is stated in a report, however.

Q. Let us take the whole length of these three claims: Yellow Jacket, 943 feet; Crown Point, 540; and the Belcher, 940. How much do you make that altogether?

A. I make it 2,423 feet.

Q. Will you be kind enough to state, General, the proportion that bears to the whole length of the lode, without giving any decimals—to give an approximate figure?

A. It is a little over $\frac{1}{10}$.

Mr. SUNDERLAND. You don't mean to say of the productive part?

A. No; of all the mines named.

Q. The entire length of the mines?

A. Yes, sir.

Mr. SUTRO. General, do you think that in the Crown Point mine, which is given here at a length of 540 feet, one half of it has the bonanza extending through it?

A. I shouldn't like to answer such a question.

Q. When you were in the mine, did you notice the length of the ore body in that mine?

A. I did not.

Q. Do you recollect anything about the Yellow Jacket?

A. Nothing about its length.

Q. There are 943 feet given here as the length of the mine. Do you think they have ore for one-half that distance?

A. No; I don't think anything about it.

Q. According to these figures here we have arrived at by examining this official report, we find that a little over $\frac{1}{10}$ of the Comstock lode was ore-producing in depth below 1,000 feet?

A. At the time the commission was in Nevada.

Q. That would give us then $\frac{9}{10}$ of the length of that whole lode, or 19,040 feet of non-producing vein and 2,423 feet of producing vein?

A. Yes; 19,040 $\frac{5}{8}$.

Q. Provided, now, that the tunnel were constructed and the lateral drift extended under all these mines, wouldn't these 19,040 feet of the Comstock lode below the 1,000-foot level derive the whole benefits of drainage and ventilation which the tunnel would furnish for nothing while they have not discovered any ore?

A. If these mines were all connected with the tunnel, they would then be completely drained of all water without a question, and they would experience certain advantages from ventilation.

Q. Do you understand that 19,040 feet out of the 21,463 would derive these benefits under these circumstances, as you saw them, for nothing?

A. If they work the mines and connect them with the tunnel, they certainly will.

Q. I take it for granted now that this tunnel is completed and the branches are all made. These people could extend these bore-holes to it?

A. They could.

Q. The connection of their shafts with the tunnel would be a natural consequence, would it not?

A. If they work the mines I think they will connect.

Q. Then, admitting that to be so, would it not be correct that the 19,040 feet of the Comstock lode would, under those circumstances, get the whole benefit of the drainage and ventilation for absolutely nothing?

A. That is certainly according to the conditions of the contract. Any mine that is connected with the tunnel will be drained and ventilated for nothing, if it is not getting out ore.

Q. In order to get at a direct answer to my question, General, will you please state whether all these mines along the lode, connected with the tunnel, and in the state you found them in at the time, that is 19,040 feet, would not derive the whole benefit of the drainage and ventilation under the terms of the contract for nothing?

A. Under the contract, if connected with the tunnel. The way in which your question is put seems to rather imply that in my opinion all these mines that you named will be connected with the tunnel, and that they will be prosecuted.

Q. I will suppose that case, General?

A. Well, if you suppose that case, and they are connected with the tunnel, they will certainly be drained without expense.

The CHAIRMAN. General Wright, will there be a complete drainage, provided the adits were run along the vein, without perpendicular holes being bored?

A. No; there must be the connection between the mine and the tunnel.

Q. But providing the tunnel were run underneath, at a certain level, would the drainage be complete without an orifice?

A. Not necessarily; probably not.

Q. The material or the rock would permit the water to percolate down to the level of the tunnel?

A. It might or it might not. As we have said in the

report, the water seems to be found in what they term their pockets. It is in places, surrounded by an impermeable seam of clay. How far these pockets will extend down nobody can tell. If they extend down to the tunnel, and were tapped at the bottom, it would drain everything. If they only go down to within 500 or 600 feet of the tunnel level, then there would be no other way of draining off the water by the tunnel than by making this connection between the working mine and the tunnel.

Q. Water only interferes with work in the mines when these clay-pockets are tapped?

A. As a rule, they are the great trouble.

Q. Then, if they tapped those clay-pockets and the water flowed into the loose or permeable rock, would it escape downward?

A. I think not. Their experience is the reverse of that. As I understand it, the Chollar Potosi shaft, which is down perhaps 600 or 700 feet below where they are working, is pretty nearly filled with water, and has remained so. They have done no pumping for a long time. The penetration of water, I think, down through, can be very little.

Q. If there were access for the water on a horizontal line cut from the bottom of that tunnel, would it not carry it away from the upper workings?

A. No, sir; the upper workings are not disturbed at all. In the Chollar Potosi the shaft is carried down to the lowest depth. They gave up prospecting there, abandoned that portion of it, and went to work on the higher levels; nothing, perhaps, below the 700-foot level; and in that portion of the mine where they are now working, above, we will say, the 700-foot level, there is no occasion for pumping at all.

Q. The water escapes in the shaft?

A. There is no water there of any amount.

Mr. SUTRO. Well, was there water there at some time?

A. I presume there was originally.

Q. If there were, wouldn't it naturally drain off into the shaft?

A. It drains off into the shaft, and the shaft is filled up pretty nearly, as they told me. I didn't go down, because they said there were no means of going down.

Q. Do you see any difficulty in making those bore-holes?

A. None.

Q. Would the expense be anything compared with the cost of mining?

A. Very little. It would be comparatively small. There would be no difficulty at all.

Q. We have here 2,423 feet of productive mine, and 19,040 of unproductive below the 1,000 foot level; consequently the work going on in the 19,040 is simply for prospecting; that is, to discover ore?

A. It is to discover ore, undoubtedly.

Q. Now, General, can you see any hardship in a small portion of the lode paying a royalty, when $\frac{2}{10}$ of it gets the benefit of the tunnel for nothing?

Mr. SUNDERLAND. That is to say——

Mr. SUTRO. Will you please let the General answer my question?

Mr. WRIGHT. Would it be an answer to the question for me to say I should suppose that that $\frac{1}{10}$ would object most strenuously to paying for any benefits to the other $\frac{9}{10}$?

Q. Would it not be a benefit to the general interests of mining, taking a rational view of it, by putting a premium on explorations in barren mines, and making the productive mines contribute something towards that? That is the principle involved.

A. Well, that seems to me to be a question which I could not well be called on to answer. I should very much prefer replying to it in a different shape from that.

Q. Well, I will put my question in a little different shape: Don't you consider it is putting a premium on explorations under such an arrangement? Is it not a sort of equalization of expenditures in the mines?

A. Why, it certainly is that.

Q. Will you permit me to read from a speech made in

the House of Representatives by the Hon. M. C. Kerr, of Indiana, covering that very point, and give us your opinion upon the correctness of that statement made by Mr. Kerr. He says:

"I think that in the original proposition there was nothing wrong, nothing unjust, nothing oppressive, nothing that in any of its characters and incidents is extraordinary, as is intimated by the honorable gentlemen on the other side. It is said that the old law organized a monopoly in Nevada. I do not understand that it does any such thing, or brings about any such result. This tunnel idea stands upon a very common one in application to various other subjects throughout the country, and it is only by the name that is given to it in Nevada that the people are misled, and do not understand just what it means. The country is everywhere familiar with various systems of ordinary sewerage and drainage in cities, towns, and the country. The obvious principles of law, of just and fair contributions for common advantages and benefits, on which they are maintained, are well understood. There is no character of monopoly or uncommon hardship about them.

"Now, Mr. Speaker, the whole of this law consists in this simple proposition: that here is to be constructed a sewer, if you please, a drain, that will inevitably benefit every owner whose property is in any way reached and drained and ventilated by it. In this city of Washington, and in all the cities of this country, it is a common practice to require the persons who derive advantage from the construction of such works to contribute to their construction originally, and to their maintenance thereafter."

In another place, in the same speech, he says:

"This tunnel company was organized at the request of these miners, at the request of the Senators and Representatives from the State of Nevada, at the request of the Legislature of Nevada, at the request of the Governor of Nevada, and of all the people of Nevada, in all the forms in which they could make their wishes known to Congress."

Further on he says:

"But it is very clear, Mr. Speaker, that while gentlemen say here that these people had a possessory right in this soil before this last law was passed, they utterly destroy the value that is in that position when they also say that the mines involved in this legislation have very great value, and that, out of the mines, these same miners have already extracted \$100,000,000 in precious metals. Now, if that be so, it seems to me that for that shadowy, that unreal, that executory—it is not that much in law—that mere possessory claim of right, they have been most munificently paid, and ought not to come back here and ask for more. But a further answer to their position is found in the fact that, when the original application to Congress was made, these miners themselves went to work and executed these voluntary individual contracts with this tunnel company, by which they agreed, whenever the tunnel was constructed, to contribute these several sums to aid its construction and maintenance."

Again he says:

"In addition to what I have said, I desire to call attention to a further fact, that under the law, which it is now desired to repeal, and under the contract which that law adopts, not one of these mining companies or individual miners is required to pay one farthing to the tunnel company in the way of royalty or anything else until the tunnel shall have been constructed, and they shall have begun to derive advantage from it. In other words, the

entire obligation is strictly reciprocal; its burdens and its benefits go together; they run constantly and perpetually in parallel lines. And the whole assumption, therefore, that there is oppression or injustice or monopoly in this matter, strikes me as being very far-fetched and purely unfounded."

A. Do you wish me to say whether my opinion corresponds with that?

Q. Yes, sir.

A. Strike out that last part of it, and I agree with it generally. I would prefer rather to give my views in my own language.

Q. Will you please state whether that agrees with your views, General?

A. With the exception of the last part of it. I wouldn't like to give my opinion about that, because I don't know anything about it.

Q. But you consider the general principle, as laid down, entirely correct then, according to this statement?

A. I consider that the Government had a perfect right to grant to the Sutro Tunnel Company all the franchises they could give them, as the Government was the owner of the mines. The present possessors of the mines, or the original possessors, those who first obtained the claims, did so without the paying of a dollar to the Government. When they were given their fee in the land, it was given to them for a nominal sum, and subject to the condition of this royalty; they could buy it or not, as they pleased.

Q. Yes, sir; but what I want to arrive at is, whether, under this system of mining of ores, we are not relieving to a very large extent the burdens of exploration below the 1,000-foot level of 19,040 feet, while but 2,423 feet have paying rock?

A. You are relieving the unproductive companies wholly and entirely.

Mr. SUNDERLAND. From what? I don't understand you.

A. From certain of the costs of operating their mines.

Q. His question was, whether you were relieving the companies having unproductive mines from expensive exploring.

A. From certain of the expenses of exploring.

Mr. SUTRO. You will, after I get through, have a chance, Mr. Sunderland, to ask the General any questions you desire.

Mr. SUNDERLAND. I merely wished to have the General understand the question.

Mr. SUTRO. We have, according to your figures here, an average in the Ophir mine of 781 tons of water for every 24 hours.

Mr. WRIGHT. Average for one year.

Q. The average per day.

A. Per day for one year.

Q. Taking that as a basis, General, we find on the table here that the Ophir mine has 1,400 feet in length, and the explorations made in that mine extend through but a small portion of that company's ground. Would you consider that that company, if it had saved the pumping or hoisting of 780 tons of water every 24 hours, would not have saved the bulk of the expense which it was under?

A. I suppose they would have saved in that year, as stated by the superintendent in his report, \$20,342 04.

Q. Taking it for granted that that is correct——

A. I have to take that for granted. I have no reason to doubt it.

Q. Well, do you believe, then, General, that they could hoist out 365 times 781 tons of water for the sum stated there?

A. It seems they did.

Q. Provided their statement is correct?

A. I assume that it is.

Q. What reasons have you for supposing that that statement is correct?

A. I have this reason, that from my intercourse with the superintendent of that mine, (and I will say the same for all,) I believe them to be intelligent men, and to have given what they believed to be an honest statement.

Q. Did they give you any indirect cost?

A. They gave us just what is there, and nothing further, that I remember. There was a great deal of conversation

upon the subject, but I recollect nothing to put in evidence, except what is stated in the paper.

Q. General, the present superintendent of the Ophir mine (Mr. Day is no longer there) gives the cost of pumping for January \$2,483 26; that is this last month. He states:

"The indirect cost of raising the water for the month of January is estimated at about \$3,000."

Consequently he gives the indirect cost at \$3,000, while the absolute cost, besides the indirect cost, is only given at \$2,483 26. Now, there are expenses connected with that that are not given.

A. I know nothing of that statement at all. I cannot see what expenses could be incurred in the pumping other than those given in this statement of the superintendent of the Ophir Mining Company.

Q. Will you permit me to ask you whether there is any difference in hoisting a given quantity of water and a given quantity of ore, supposing the former were hoisted?

A. There would be a great deal of difference.

Q. How much do you think that difference would be?

A. I couldn't answer. It depends upon the way in which the ore is raised.

Q. Well, supposing they take their water out with a large water tank. This tank is lowered down into the sump, a valve opens in the bottom, and it fills up; and it is hoisted to the surface. It is an instantaneous operation, the filling up. You have a single tank, and the only additional weight you hoist is the weight of the tank besides the water. Now, how would that compare with pumping the water?

A. It would probably cost considerable more.

Q. How much do you think, allowing for the friction in the pipes used in pumping?

A. That would be quite impossible to tell. There is no way that you can raise any less weight, or raise it perhaps any more favorably, than by this tank, so far as the mere hoisting is concerned; but there is a certain time when

there is an absolute waste of power in the use of that mode. For instance, all the time the tank is going down there has to be a certain power exerted to retard its progress, and there is an expenditure which they do not get in the other cases. Moreover, the absolute power required to be used at any one moment is less with a pump, in the way in which they have them arranged, than it is in bringing up this supply of water. By means of a counter-weight, they apply something like one-half the power at the given moment; the expenditure is very much the same in the two cases, that is, you have got to bring this counter-weight back again, and that is attended also by an expenditure of power. The application is more favorable by a pump, arranged as they have it there, than it is by a hoisting tank; but what the difference is depends entirely upon the character of the machine.

Q. General, let me ask you another question in regard to that. Don't you require a horse-power for every 33,000 pounds of water that you lift one foot high in one minute?

A. That is what is called a horse-power. That's the conventional value of a horse-power, raising 33,000 pounds one foot high in one minute.

Q. Can you get over the fact that you have to have a horse-power, no matter what the mode, or how you manage it, to raise every 33,000 pounds of water or anything else one foot high in one minute—whether you pump it or hoist it?

A. You certainly have got to expend that power unquestionably.

Q. Then the mechanical question is this: How would the friction in the pipe—

A. Which is considerable.

— compare with the additional weight of this tank which you have to hoist every time? Do you consider that there is a material difference?

A. I should think the friction in the pipes would be more than the weight of the tank, that is, the power re-

quired to overcome that friction would be greater than that to raise the weight of the tank.

Q. Well, do you think there is 25 per cent. difference, at a rough estimate, without going into any detailed figures?

A. Well, this is a thing that is susceptible of a good deal of accuracy. Machinery does not make power. You have got to overcome the weight of the water you raise, no matter what devices of machinery you may apply. One machine makes the application of power much more economical than another, and that is all. The force necessary to raise this water to the surface must be applied, whatever machinery you use. No machinery can allow you the application of less power. In one case you apply it all the time in one direction; in the other case, you apply it in two directions; and by the time the water is at the surface, supposing all other things are equal, as regards weight and as regards friction, (we'll take those out for the purpose of illustration :) by the time that water is at the surface, you must have expended all the necessary power for raising that water to the surface.

Q. But supposing you make a liberal allowance. You say it costs double in a tank what it costs in a pump.

A. I don't think it would cost double, and if you had two tanks, one running against the other, I shouldn't suppose there would be 10 per cent. difference; I should think it would be more a matter of convenience than of cost.

Q. Supposing we take two-thirds or three-quarters of the cost to arrive at some figures, say allowing 25 per cent. more on one side than on the other?

A. Well, you can allow it.

Q. To arrive at some positive figures. You have given the cost of hoisting ore at 51 cents per ton?

A. Yes.

Q. Now, let us deduct 25 per cent., which would give us 38½ cents per ton for hoisting water.

A. But you mustn't understand that that is any compari-

son. The cost of raising a ton of ore is a great deal more than the cost of raising a ton of water.

Q. Now, take 780 tons of water every 24 hours in the Ophir mine; that gives us \$300 a day?

A. Yes, sir.

Q. Or \$9,000 a month, or \$108,000 a year for pumping, even allowing 25 per cent.; \$108,000 a year for pumping, taking the estimate which these people furnish for hoisting, and that is very low. I contend that they have not given the right figures on that. It would cost \$108,000 per annum. Mr. Day gives the cost of pumping at \$29,317 04. In your judgment, could there possibly be that much difference between the two?

A. Oh, I don't think that there is that difference. I think, as I said before, that he has stated these sums as a very close approximation. Their books are very well kept, and they can get at a very close figure as to the cost of any part of their operations, and unless Mr. Day has willfully falsified his report, the statement is correct. I would say that there is a great difference in cost between the hoisting of ore and the pumping of water. One is a continuous operation; the other is intermittent. As I gathered from the mines, the best of them can hoist only about 250 tons of ore a day, while we show here from their own accounts that they pumped 700 or 800 tons of water daily.

Q. Did you see the books of the Ophir company, and examine them, to find out whether these figures are correct?

A. I only looked at their books generally.

Q. Did you go into the figures and figure it?

A. I didn't go into the figures with any method.

Q. Then you based your estimates simply upon the statements furnished by these men?

A. That is all we profess.

Q. Now, supposing we take this estimate here of \$108,000 a year for that one mine, and give that for a thousand feet in length on the lode as the cost of pumping, then in

22,000 feet we get a cost of \$2,376,000 per annum for pumping?

A. Very likely.

Q. Provided all the mines were opened up and worked to that depth. You see that makes a very large difference between the statement which you arrived at by taking the figures of these superintendents, making it \$124,000.

A. Certainly. Your statement is entirely different, and I can make one very different from that, if I make certain assumptions. I can only give you evidence as it was presented to me. I have no further evidence to offer in any way.

Q. The fact that I want to arrive at here is simply this: You have taken the statements of these superintendents, supposing them to be correct?

A. Believing them to be correct.

Q. You had no other way of getting at them at all?

A. No, sir.

Q. You were there visiting these mines, and you went to those gentlemen and asked them what it costs to pump. You have taken that as your basis, and you have given your figures in accordance with the statement those people furnished?

A. Undoubtedly.

Q. Now, General, while we are on figures—I see you are pretty good on figures—I want to ask you about this water power on the Carson river, and you must pardon me if I ask you a good many questions about it. These are very important matters.

A. I will answer any question that I can answer, but I may as well say it now, that I shall object hereafter to supposititious questions being forced upon me—questions which it seems to me tend to convey a judgment entirely different from the one that I possess. I shall have to do that in justice to myself. I think that some of these questions are calculated, if answered, to indicate a judgment different from the one that I have expressed in the report, and a different one from what I hold.

Q. I might as well state to you, General, here, that I question the correctness of these statements furnished by these superintendents. You have not heard the previous testimony furnished by the other commissioners, in which we have shown the incorrectness of these reports to you. It would be quite impossible for me to go over the same ground again with you, but if you read the whole testimony afterwards, you can form your own conclusion whether these superintendents have stated the whole truth or not. You can arrive at that conclusion, and you will then perceive that my questions to you may be supposititious questions, but, at the same time, they have a very strong bearing upon the general facts contained in the report. Now, General, I want to ask you a few questions in regard to this water power which may be created at the mouth of the tunnel. Surveyor General Day, on page 45, gives the average section of flow of Carson river, at the rate of four miles per hour, at $508\frac{3}{100}$ square feet. Taking that as the basis of our calculation, with a fall of 255 feet, we get, at a flow of four miles per hour, 21,120 feet of flow per hour. Dividing that by 60, we get 352 feet per minute. Now, if we multiply the section of $508\frac{3}{100}$ feet by 352 feet, we get the cubic feet which flow through the river per minute, which is $178,932\frac{1}{100}$ cubic feet.

A. That is correct. I have no fraction.

Q. Now, a cubic foot of water weighs $62\frac{3}{10}$ pounds?

A. I calculated it at $62\frac{1}{2}$ pounds.

Q. How many pounds do you get per minute at your figures? We'll take your figures now.

A. I get 11,183,250.

Q. Per minute?

A. Per minute.

Q. Dividing that by 33,000, we get the horse-power for every foot of fall. How much do you make that?

A. I make it 339.

Q. If you multiply that by 255 feet of fall, we get a total of horse-power, according to your calculations, of how much?

A. Of 86,445.

Q. I figured it at 86,139; but you take a different weight per cubic foot of water.

A. It makes a slight difference.

Q. General, a power of 86,445 horses is a power that would work a good deal of ore, will it not?

A. Certainly.

Q. Do you think that it is power enough to reduce all the ore produced in the State of Nevada and every other territory that is producing ore, provided it could all be economized?

A. It will furnish all the water-power that will be needed in that section, if that is sufficient. It would be abundance of water power for the work of all the mills on the Comstock.

Q. How much power is required to reduce a ton of ore?

A. I do not know.

Q. Mr. King has fortunately given us some information on that subject. He states, on page 231 of his report:

"The power required for each stamp of ordinary or average weight, with the allowance for friction, is about $1\frac{1}{2}$ horse-power per stamp. The power demanded by the pans is from three to six horse-power, according to their size and capacity. The expenditure of power per ton of ore crushed, ground, and amalgamated, judging by the relation existing between the power of the engines provided and the work performed by the mills, is between $1\frac{1}{2}$ and 3 horse-power, averaging probably about 2, but varying according to the capacity of the mills and the economy with which the power is applied."

He gives us two horse-power required to reduce one ton of ore. We have here 86,445 nominal horse-power.

A. Yes.

Q. Now, we will have to deduct a certain amount for friction and loss in power, in order to arrive at the actual horse-power. This is the theoretical horse-power?

A. No, I think not, in the way he puts it there. I suppose he includes the friction and everything. If two-horse power be a fair average, as he has it there, he includes everything in the reduction of the ore.

Q. Then, according to that statement of Mr. King's, which is derived from a general examination of all the mills, (he spent six or eight months there; may-be a year,

for all I know; and they had him examine these things in detail; they had a whole corps of engineers with them,) we have actual power to reduce 43,220½ tons of ore a day. We find it stated in your report that the average yield is 1,000 tons per day; and at that rate there would be power enough left to reduce 42,000 tons per day, besides what is taken out of the Comstock lode now?

A. Yes, a little over 42,000 tons.

Q. Well, wouldn't you consider that that surplus power would be sufficient for the purpose of condensing air and running all the engines that would be required to go down below the tunnel level?

A. Well, I should think it might, certainly.

Q. Don't you think, in addition to all that, that there will be enough left to drive all the concentrating machinery?

A. Certainly.

Q. And any other kind of machinery that might be required?

A. Certainly.

Q. Wouldn't there be a surplus of power then?

A. I should think you would have an abundance of power.

Q. Now, General, in taking the whole of this water power, by having it dammed up as is proposed, and collecting the surplus in a large reservoir, instead of having little dams that only economize a portion of the river, and sometimes in the year have no water at all, wouldn't it be immensely more beneficial?

A. We have given that as the opinion of the commission in the report.

Q. Wouldn't that in fact be the maximum of utility with which that water could be applied in that river.

A. I certainly think so. I see no other way in which it can be applied with anything like the economy, or value, or extent.

Q. I am now brought to the question of erecting mills and concentrating works at the mouth of the tunnel. Do you think, in the first place, that the formation of

the country, from the mouth of the tunnel down to the river, is of such a character as to give great advantages in erecting self-acting or other automatic concentrating works, where one discharges itself into the other, simply by the flow of water, without handling or the labor of men?

A. I think the ground in front of the tunnel, between it and the river, is admirably fitted for the application of this water power, and any purposes to which it is desirable to apply it.

Q. Could we improve anything in its nature, so far as that site is concerned—a natural slope from the mouth of the tunnel a mile or a mile and a half down to the river?

A. I think that art will have to be brought to the assistance of nature but to a very small degree.

Q. But as far as the grade is concerned, isn't it fitted by nature for that very work?

A. Well, it is well fitted. I don't think you could desire a better situation for mills and reduction works than is afforded by the ground between the tunnel and the river.

Q. So far as the space is concerned which we have there, could there be anything more desirable than that?

A. There is an abundance of space.

Q. There are hundreds of acres, or even thousands, are there not, that might be employed, if necessary?

A. It is practically unlimited.

Q. Where those mills are now situated in the cañons—

Mr. SUNDERLAND. Which mills do you speak of?

Mr. SUTRO. I will name the mills in Gold cañon or Six Mile cañon. Is there any space there to erect concentrating works and reduction works on a large scale to advantage?

Mr. WRIGHT. Not to equal advantage certainly; but the objection to erecting reduction works in these cañons is the want of water. That in itself is a nearly insuperable objection to their being put there.

Q. It would make it practically impossible to have reduction works there?

A. On a very large scale, certainly; I think it would.

Q. The first requirement, I infer from your statement, is an abundance of water?

A. An abundance of water.

Q. In fact the water takes the place of the labor of men by its own flow?

A. Water is necessary in these works, absolutely necessary for the purposes of concentration and reduction. The power applied may be steam power instead of water power, but water is still absolutely necessary to the reduction of the ores of the Comstock.

Q. In coming back now to these small mills, erected on the banks of the river, have they any opportunity there to erect concentrating works, and is there fall enough to make self-acting or automatic works possible, such as you would get at the mouth of the tunnel?

A. The answer to that question seems to me to be that they have not power enough even to run their stamps at certain seasons. At the time we were there, a great many stamps were hung up in all of the mills along the Carson river.

Q. Then, independently of that, is there space enough and fall enough to erect concentrating works upon an intelligent basis on any scale that would be profitable?

A. That I cannot answer very positively; but I should think, in reference to some of them, that it was possible; with others not.

Q. Would it not be very limited, with a fall say of from 12 to 20 feet, as it has been stated here?

A. I don't see why they should attempt to put further works there, when they have not power enough for the works they have at present. That seems to be meeting the point, if I understand the object of the question. About the Mexican mill there is a good deal of space for concentrating works, but they want all their power for their present works, and more power at certain seasons of the year than they can obtain there.

Q. As far as you could learn, are these small dams all

along the river and their works subject to being flooded and carried off by freshets?

A. Not to my knowledge.

Q. I find an account here of the Mexican dam being carried away a little while ago.

A. That may be so.

Q. You were there only in the dry season?

A. That was all. There is no difficulty about putting up dams there that will stand any pressure that can be brought to bear. Whether they have been so constructed I cannot say.

Q. In regard to the land at the mouth of the tunnel, I want to ask you whether you do not consider it a more desirable locality for the residence of people than Virginia City?

A. I certainly do.

Q. Is there not an abundant space there for the laboring men, where they could own their own cottage and have a little plat of ground to cultivate, and keep a cow, and get some of the comforts of life, which they cannot get at Virginia City?

A. It is certainly a good position for a mining or milling town.

Q. Would it not improve the condition of these miners, who work only 8 hours and have 16 hours of leisure, if they were so located that they might employ themselves in useful work about home?

A. I cannot answer that question.

MR. SUNDERLAND. Mr. Chairman, I want to make one objection. I don't like to make objections, because I leave them to the committee, generally. I scarcely think it is within the province of Congress to determine upon the desirability of location for miners or anybody else to live, and by congressional legislation to compel a man to reside either in one place or in another. Now, if a man wants to live at Virginia City, it seems to me he ought to be allowed to live there, and that Congress should not appropriate public moneys out of the Treasury to compel them to go

down to the mouth of this tunnel. I don't see how that has any bearing upon this question.

Mr. SUTRO. Mr. Chairman, I don't see that it is an objectionable question to ask. Here is a question of making a great improvement in the operation of mining. We find here that there are some 3,000 or 5,000 men employed in the mines and in connection with the mills—probably 10,000, take them all together, the wood-haulers and every one else—and I believe it is a proper thing for Congress to find out, in connection with this question of mining, whether the comforts of these masses of people would be improved in comparison with the interests of the owners of a mine, which you can count as a few dozen. The interests of a few proprietors might be one thing, and the interests of the laboring classes might be another. These men have certain rights; and, if I understand aright, Congress represents the whole people of the United States: it don't represent the few men who are owning mines, and probably not working them legitimately, but for stock-jobbing purposes. I believe these laboring men have some rights, and I don't see what objection there can be in answering such questions. This is a general investigation in regard to improving the working of those mines, and consequently the condition of the men.

The CHAIRMAN. I don't see that a great many of the questions that are asked have any bearing whatever upon the facts, or upon the report under consideration by the committee; but if it is the pleasure of the committee to permit irrelevant questions, why of course I am willing. If the gentleman who put the questions will state the object he had in them I think it would lessen the volume of the testimony.

Mr. SUTRO. Mr. Chairman, the object in asking this question is this: In some previous testimony which was taken it was stated here that great hardships would accrue to some of the people of Virginia City if the town were removed to the mouth of the tunnel; and I put this question in regard to the advantages at the mouth of the tun-

nel. I want to bring out these facts in comparison with the difficulties which exist at Virginia City. Our investigation has taken a very wide scope. There is no doubt about it. But there has been a controversy over this matter, Mr. Chairman, for years. Simple facts, patent to the mind of any one, have been disputed; and they have not only been disputed, but they have been disputed a thousand times after they have been established as correct. This is an investigation by Congress upon this subject, and it is very desirable that these facts should be established and put upon the record. Congress appointed a commission, at least the President appointed commissioners under an act of Congress, to go out there, and they did so. They followed out the instructions of Congress and the law; but while they were there their investigation took a larger scope, of course. They saw a great many things and knew a great many facts which I desire to establish here, and which have been disputed. I consider it as very desirable to arrive at the truth in regard to these statements, and I should very much like to have the General answer the question.

The CHAIRMAN. It is very evident that the latitude given for examination of a witness in one case invokes it in another. The question is whether your line of interrogatories is confined to the subject-matter of the investigation. As far as I can interpret it, I think not fully. If this information is desired to meet certain objections made, whether in the line of testimony or otherwise, I shall not object to it.

Mr. SUNDERLAND. I have no objection, Mr. Chairman, to any question in the world. I have made several objections, but I find they haven't had the desired effect. I am willing to do anything that the committee desire. As a matter of fact, everybody that lives out there knows that the Carson river and the Carson valley are the most sickly part of that State, and the most undesirable for a residence or location.

Mr. SUTRO, (repeating the question.) Would it not improve the condition of these miners, who work only 8 hours

a day and have 16 hours of leisure, if they were so located that they might employ themselves in useful work about home?

Mr. WRIGHT. I don't know.

Q. Why, do you think it wouldn't be useful?

A. I don't say that I don't think it will be useful. I simply say I don't know.

Q. What opportunity have men running about Virginia City to occupy themselves?

A. Much the same that they have in other towns.

Q. Do not many of those miners have families, General?

A. I so understand it.

Q. Well, if they had an opportunity of building up a little home down there, do you not think that a great many of those men would improve it?

A. That I cannot say. I suppose they have opportunities for building up homes in Virginia City.

Q. Well, is there a possibility of their having a garden, or water to irrigate a garden?

A. No, they can have no garden at Virginia City.

Q. Won't they be compelled to live on the side of a hill?

A. Certainly.

Q. Kind of a roost upon a rock?

A. Well, some of them are very comfortable.

Q. General, I wish to ask you one more question in regard to the mouth of the tunnel, and that is, whether you believe that it is suitable for gardening—whether the land there is fit for agricultural purposes?

A. So far as I passed over it, it certainly is, with a supply of water for irrigation.

Q. Have you seen any gardens at the mouth of the tunnel?

A. I have. There was a very fine garden near the mouth of the tunnel.

Q. Did they raise any good vegetables there?

A. They certainly did. They were as good as they have in Virginia City—better.

Q. Now, General, my questions run rather from one point to another, but I cannot help that. I have gone over many points that I didn't wish to recur to; but there are others that I do. I want to ask you whether the water in the mines could not be carried down in pipes to the tunnel level, and be economized for the purpose of driving hydraulic machinery at the point of connection?

A. It certainly could be done; but whether it could be done economically or not is more than I can say. It depends upon the quantity of water and the constancy of the flow.

Q. I want to ask you, General, whether you know anything about Professor Weissbach?

A. I have heard his name.

Q. Isn't his name familiar to every engineer, as you may say, in the world?

A. I don't know. I cannot say as to that.

Q. Isn't he looked upon as the great authority?

A. He is considered as authority upon many matters.

Q. Well, Professor Weissbach, in a letter addressed to me in October, 1867, states:

"A tunnel which, with a length of about one German mile, opens up rich ore a depth of 2,000 feet, secures to the professional mining engineer the most welcome and surest means of profitable operations, particularly in a country where no cheap fuel exists for the purpose of generating steam power. Such a tunnel removes, *firstly*, the necessity of using pumping-engines for many years to come. It facilitates and cheapens, *secondly*, the extraction of ore and waste rock in an extraordinary manner.

"It gives, furthermore, *thirdly*, many opportunities for additional exploration of the country, and discovery of new bodies of ore. The tunnel also, *fourthly*, makes it possible to derive a profit from the great masses of poor ores.

"The connecting and air shafts of the tunnel will, *fifthly*, secure to the mines perfect ventilation. Finally there will be created, *sixthly*, a motive power by saving the water on the surface, and conducting it by hydraulic machines, for instance turbines, water pressure engines, &c., placed in the mines, which let the water flow off on the tunnel level, after having done its duty, and which not only will entirely remove the necessity of steam-engines, but also promises the greatest profit, particularly if the supply of water can be made to last the year round.

"With a fall of 2,000 feet, the working power created by one gallon alone, $= \frac{1}{8}$ cubic foot $= 10$ pounds water per second, is equal to 20,000 pounds for every foot, that is $= \frac{20000}{330} = 36$ horse-power. A quantity of water of 50 gallons introduced per second would therefore create a working capacity of 1,800 horse-power."

Now, I want to ask you, General, do you not consider

the power which may be created on the Comstock lode as very large to propel the pumps that are going down below the tunnel level, taking our figures here of 730 tons a day in the Ophir mine, &c., supposing that water were to be collected, say 800 feet down, and carried down in pipes to the tunnel level?

A. That number of tons, with a fall of 1,000 feet and a constant flow, would create an enormous power.

Q. Yes, sir. These gentlemen have stated that the largest quantity of water in these mines is in the first 800 feet; consequently you would get an immense power from this water, if it be collected 1,000 feet above the tunnel level?

A. Yes; but that water has been pumped out to a large extent.

Q. But we have the statement here that they have been pumping in the Ophir mine, even last year, 781 tons every 24 hours. Then we have the amount of the Gould and Curry mine, which has a larger quantity of water.

A. In general terms, the power would be equal to the power of raising it that distance.

Q. It would be about the same.

A. Something like it.

Q. Now, wouldn't that give you a power to go below that tunnel, without any steam machinery, to a large extent?

A. It would to a certain portion, undoubtedly, and a considerable amount of power.

Q. Is it possible to create any such power without a tunnel?

A. If you mean by the question, whether it is possible to utilize this water in the same way without the tunnel, I would say no. I see no way.

Q. It would be quite impossible, without an outlet to discharge the water?

A. I should say so, decidedly.

Q. Then the water coming from above would create this power, and it would pump the water below the tunnel level

up to the tunnel level, and discharge it from the mouth of the tunnel?

A. From a certain distance below, it would.

Q. Well, with this water power, and the condensing of air at the mouth of the tunnel by the Carson river, to be carried in in pipes, would we not, in your opinion, have sufficient power to carry on operations at least 2,000 feet below the tunnel level?

A. If they can obtain 86,000 horse-power at the mouth of the tunnel, I think it will furnish all the power in itself that is necessary for going down an additional 1,000 feet.

Q. Now, in condensing air, and discharging that air say at any point in the mine where great heat exists, would it not tend to cool off the atmosphere?

A. Certainly.

Q. Do you know any rule about the heat which is lost in allowing this air to expand again?

A. Heat that is absorbed—made latent?

Q. Yes.

A. I forget the law. It is a well-established law.

Q. Cannot the air be condensed to such a point, that when it is allowed to expand it would even congeal water? Has it not been used, in fact, for the manufacture of ice, or could it not be so used?

A. I see no reason why it could not be used; and it was used, I think, in France, for that purpose. It isn't the device used in this country. We have another, which is considered superior.

Q. There are probably superior methods; but my question is, whether it will be possible to do it?

A. I see no impossibility.

Q. Don't you look upon this as solving the problem of working those mines, with the immense heat that is supposed to exist below the tunnel level?

A. This same thing can be done, of course, from the surface, but at greater cost.

Q. Wouldn't the cost be prohibitory? Would it be possible, with the enormous cost of wood near the surface, to

carry out that project—to condense air on a large scale—in order to cool off those mines below?

A. That would depend entirely upon the value of the mine and the necessity of doing it.

Q. Supposing that tunnel to be finished, the lateral drifts finished, and a great number of shafts, say 25 shafts, connected with the tunnel along the route, which could be constructed very easily, as we have shown; by putting down bore-holes first, would you not consider that, by connecting all these shafts by drifts, these would in the course of time (say two or three years) reduce the temperature to a very large extent?

A. Yes, I think any constant ventilation tends to the reduction of temperature in the mine.

Q. Well, what do you think would be the capacity of the men to do work with the thermometer say at 105° , as compared with a temperature of 80° ?

A. I have no means of making a comparison at all. I only know that men were working there and apparently doing good work, in a temperature that I could with difficulty stand. And these very men assured me that they preferred working there to working upon the surface. I didn't understand it myself.

Q. Do you believe that a man can do as much work with the thermometer at 110° degrees as he can with it at 80° ?

A. I have no idea that he can.

Q. Do you think he can do half as much?

A. What the proportion is is more than I can say. I should like to answer the question, but I have no means of judging. They were doing work there that it seemed impossible for men to do.

Q. Don't you think they injured their health?

A. They said, as a rule, not.

Q. Do you think they were long enough there to find out—these men that you spoke of?

A. I suppose so; they were miners by profession.

Q. Do you know anything about the health of those miners?

A. Only what they said themselves : that they enjoyed good health usually. One of the men, quite an intelligent one, said that in most of the mines the men work through their eight hours without intermission ; but at some points they are relieved every 15 or 20 minutes, and that 3 men are required at one pick, on account of the heat and bad ventilation. The ventilation, however, is much improved of late by means of pipes, through which the air is forced into and through the mines. He said, the general impression among miners was, that the bad air, heat, &c., were injurious, but that he had never suffered in health, and was not prepared to say that working in the mines caused disease or shortened life. He did think, however, that with better ventilation and less heat more work would be done.

Q. There are on the Comstock lode 3,000 miners. They get on an average \$4 a day ; that would make \$12,000 a day. With an improved method of ventilation, if even 25 per cent. in labor would be saved, it would amount to \$3,000 a day ?

Mr. SUNDERLAND. The General has not stated that any per cent. would be saved yet.

Mr. SUTRO. It is my question that I am putting.

Mr. SUNDERLAND. You are taking a basis that we have not assented to.

Mr. WRIGHT. I couldn't give the increase of the amount of labor with the reduction of the temperature.

Mr. SUTRO. I want to know whether you consider it a conclusive statement that, provided there is a thorough ventilation brought about in those mines, the gain would be 25 per cent. ?

A. I don't know. I have no means of forming an opinion. I should be glad to answer the question, but I cannot. In reference to the Yellow Jacket, the men who were questioned did not seem to think their work worse than on the surface, in the sun, or more detrimental to health. All of them looked strong and hardy. The copious perspiration does not seem to reduce the miners in flesh. I talked

with a good many miners in that mine, and went about in the mines, and that was the general character of their testimony.

Mr. SUNDERLAND. That was the hottest mine there that you were in?

A. It was the hottest mine there by all comparison.

Mr. SUTRO. My question is, whether the capacity of these men at the lower temperature would not be considerably increased?

A. I should think it would be increased. I don't see how it could be otherwise. Still I am bound to say, in continuation of my answer, that the men seemed to be doing good work whenever we were present—as much as, it seemed to me, could be reasonably expected of men. I was surprised at it.

The CHAIRMAN. General, what is the increase of temperature—the ratio of increase—as you descend?

A. I believe they calculate it as somewhere near 1° in every 50 or 60 feet. It varies in different mines. I don't remember what it was in this mine. I don't remember what it was at the surface. I went down, and I got into a temperature there of 104° .

Q. At what depth?

A. This was at the 1,100-foot level. But I should remark, that there were no miners at work in that temperature. This was in a drift that run out. It was a *cul de sac*, and the heat was in this. At the end there was one of these air-pipes, in which air was forced from the surface, and there the heat was 91° , with a very different atmosphere from what you found perhaps 100 or 200 feet short of it. It didn't seem to be so much the heat as the character of the atmosphere, which was oppressive. Before reaching the heading or by the time I arrived there, I was exceedingly doubtful whether I should be able to get out; but I remained there and talked with a workman for perhaps 15 minutes without inconvenience. Before starting out, however, I put my face up to the end of the air-pipe and inflated my lungs, and I got out very well, but

without that I think it would have been impossible for me to have done it.

Q. Is that increased heat from the earth's temperature or the confinement?

A. The heat is undoubtedly occasioned by the earth's temperature. The sides, top, and bottom of the drift radiated the heat.

Q. In your opinion would the ratio of that increase reach such a point in going down that, at a given depth, it would be impossible to work these mines?

A. At some certain depth a heat will be attained in which it will be impossible to work. In the English mines they appear to have arrived at the limit—which is there about 3,000 feet—in the coal mines. Those same figures might not obtain at the Comstock. It might be greater or less.

Mr. SUTRO. General, will you allow me to read from an English work on mining, which gives some very intelligent views upon ventilation, and I want to ask you in regard to the correctness of them:

"Hitherto, few systematic attempts have been made to supply the mine with the requisite quantity of atmospheric air, and the consequences are seen in the large proportion of fixed air in moiety of the workings. This inattention to a matter of such vital importance to the health of the miner is inexcusable in every respect. A current of atmospheric air is conducted through narrow torturous passages, of several miles in extent, with such facility and at such trifling expense, that no reason can be adduced why one-half of the miners in Cornwall and Devon should be working in a highly poisonous atmosphere." (*Page 94, Scoffran on the Useful Metals.*)

Then he goes on to say, on page 111:

"It is unnecessary to enter at length into the effect of the variety of exhalations and miasmata proceeding from the putrid fermentations of animal and vegetable matters underground, as they are well known even upon the surface. In these confined channels, where the accumulations exist at every step, the warm, moist atmosphere gives them every facility to produce their direst effects. When it is considered, however, that each workman produces 46 pounds of excrement per month, and that this, neglecting all sanitary laws, is allowed to remain in and about the working places, and in the dead ends, where the air current does not enter, it is evident that a fertile source of miasmata exists, whatever care may be used in covering the deposit.

"The miner has good grounds therefore for demanding a high rate of wages, and he is especially in need of the assistance of benefit societies in his period of trial."

On another page:

"In pits, with a rapid circulation, men respire more freely; the roadways are kept dry and repaired at less expense; and the timber lasts longer by years, and therefore it is a matter of strict economy to secure a good ventilation. There are few mining engineers who will not subscribe to the justness of the report of 1842: 'That a mine, when properly ventilated and drained, and when both the main and side passages are of tolerable height, is not only not unhealthy, but, the temperature being moderate and very uniform, it is considered as a place of work more salubrious, and even agreeable, than those in which many kinds of labor are carried on above ground.'"

I want to ask you whether the opinions expressed by the writer here meet with your views?

A. Generally, I should say yes.

Q. It has been mentioned here that timbers last longer by years?

A. Undoubtedly they last longer in a well-ventilated mine than where the air is close and stagnant. That is undoubted.

Q. It has been stated, in some of these reports, that 16,000,000 feet of lumber or timber are consumed in these mines of the Comstock lode per annum. That in ten years would be 160,000,000 feet. Supposing that timber could be made to last three or four years longer than it does, would that not be a great economy to those mines?

A. Undoubtedly it would be an economy. Every timber that is replaced is a source of expenditure.

Q. You have visited the workings of the Crown Point and the Yellow Jacket?

A. Yes.

Q. They were connected by drifts?

A. Yes.

Q. You found good ventilation there?

A. I found a pretty good ventilation.

Q. How far apart were those two shafts about?

A. I should think 600 feet would be about the distance.

Q. How would you connect the Imperial and the Hale and Norcross shafts, a distance of some three or four thousand feet? Would you think it feasible to make a connection at every hundred feet descent without sinking additional shafts between?

A. I don't think it has ever been proposed.

Q. Well, how would you ventilate the space between the Hale and Norcross and the Imperial?

A. There is no necessity at the present time.

Q. Supposing they wanted to explore it?

A. Then they must explore it by means of a connection between the two, or by additional shafts, or by means of air forced down from the surface.

Q. Would it not be the greatest economy to sink down a deep shaft at least every 1,000 feet?

A. That depends entirely upon the object they have in view—what they are to find.

Q. I mean in order to explore the whole Comstock lode the most thoroughly?

A. Well, that is a question of economy of working which I could not answer.

Q. Would the working of the mines not be very much facilitated if there were a great number of shafts down and connected with the tunnel?

A. Unquestionably.

Q. Supposing there be a shaft down every 1,000 feet, connected with the tunnel, would it not facilitate ventilation?

A. It would all help.

Q. I want to ask here, General, whether, from your investigations, you have become satisfied that there are immense bodies of low-grade ores in those mines?

A. The testimony obtained by the commission is in favor of the existence of a very large amount of low-grade ores in the mines, that either have not been mined, or have been thrown aside as useless, or used in fillings.

Q. If large reduction and concentration works were established at the mouth of the tunnel, would it be possible to work these ores to advantage?

A. That was a question upon which the commission was in doubt, as to the possibility of improving this matter of concentration to any degree. It had been represented that very great improvements might be made, in which a very large part of the precious metals, which are now lost, could

be saved; that this work could be done automatically, and at a comparatively slight expense.

Q. Would not the actual cost of reduction, as it is practiced now, be a good deal less at the mouth of the tunnel by the employment of large water power and the establishment of works on a large scale?

A. That would of course depend entirely upon the original outlay for this water power. The power costs nothing after the first outlay.

Q. Could the power be furnished to reduce ores at a less cost, where you do it on a large scale, than in these isolated little mills?

A. I should think so. If this were an original proposition, I should say certainly.

HEARING FRIDAY, MARCH 1ST.

Cross-examination of General Wright.

Mr. SUNDERLAND. General, I think the other evening you named the dimensions of this tunnel, did you not?

Mr. WRIGHT. I think I did. It is given in the report, however.

Q. Yes, you give it at 12 feet in height. (Page 5.)

A. Twelve feet; width of bottom, 14 feet; top, 13 feet.

Q. Where did you get that from?

A. We got it from a drawing that was remitted to us by Mr. Sutro, or by the superintendent, I forget which.

Q. You didn't get it from the act of Congress, or the contract between Sutro and the mining companies?

A. I did not.

Q. Do you know what these contracts were for?

A. I do not.

Q. I will read you from page 176, article 6, in the contract:

"The dimensions of said tunnel shall be not less than seven feet in height, in the clear, and eight feet in the clear in width."

Would that size of tunnel have sufficient space for the management of this ore and the transportation of ore and debris?

A. Seven feet in height and eight in width?

Q. Yes, sir.

A. I should think not. I don't think the present size of the tunnel any too large—the tunnel as now proposed.

Q. Do you know when the shafts upon that tunnel were commenced on the line of the tunnel?

A. I do not. They had not been commenced when the commission left Nevada.

Mr. SUTRO. I can answer that question, Mr. Sunderland. They were commencing on the 27th of December last.

Mr. SUNDERLAND. Have you any practical experience in mining or milling, General?

Mr. WRIGHT. I have not.

Q. Do you expect, page 6, you enumerated the advantages of the tunnel, as claimed by Mr. Sutro; first, in the improved ventilation of the mines?

A. Yes.

Q. Now, to what extent would the ventilation be improved by the tunnel?

A. It would be improved to exactly the extent to which the column of air moving in the tunnel and passing up through the various shafts would benefit it. It is an extent which cannot be expressed in figures definitely in any way that I can think of.

Q. It's guess-work, is it not, to a great extent?

A. I don't think that the exact number of cubic feet of air that would pass up the mines in a given time can be determined until the tunnel is in working order.

Q. I don't mean to say, General, that I dispute the proposition that the ventilation would be improved, because it will be improved by every opening that you make to the mines from the surface; but the degree, or the percentage of the improvement, if you have arrived at any conclusion, is what I want to get at.

A. I don't think that that can be foretold. It would depend upon the rapidity with which this current passed through the tunnel; and that cannot possibly be determined beforehand.

Q. From your knowledge or information, derived while you were out there, did you arrive at a conclusion as to whether the mines were better ventilated now than they had been some years ago?

A. We arrived at the conclusion that the ventilation had been materially improved, as is stated in the report.

Q. Is it possible, General, to ventilate new exploring drifts in the mines from the tunnel, unless you use other means aside from the air coming into the tunnel—artificial means for directing the air?

A. It is quite impossible, so far as I know or can imagine.

Q. You were more than once in drifts between the Yellow Jacket and the Crown Point, I suppose?

A. Twice.

Q. What is the movement of the air there?

A. There is quite a strong current, so much so, that they had doors which they could close at will in that drift, to cut off the air.

Q. If there were no doors in that drift, would it be possible to carry a lighted candle there?

A. I should think not.

Q. Did you have any difficulty in carrying a candle through the door when it was open?

A. I don't remember, but I know of many cases in which I had considerable difficulty in carrying a candle, and I was not able to keep it lighted, except by carrying it in the way I was told it could be best carried.

Q. Now, what is the length of the Comstock, as you understand it? I believe you give it at about 22,000 feet?

A. About 22,000 is claimed for it, and I think about 12,000 of it is worked. That is my recollection.

Q. Will the amount of air that could go through that tunnel be sufficient to ventilate the whole of the mine if it were open?

A. That alone?

Q. Yes.

A. I should think not.

Q. With the heat and the mode of mining there now, how much of a mine is left open at any one time, so as to make it necessary to ventilate it? In other words, when the first floor is worked out on any level and timbered, are the spaces between the timbers or timbering left open or filled up?

A. They are generally closed—filled in.

Q. Ain't that absolutely necessary to prevent the caving or crushing in?

A. Yes, sir; the object is to prevent caving.

Q. Ain't it necessary?

A. I should suppose it was.

Q. What is the largest width of ore, or a space worked out of ore, that you saw there?

A. Well, I didn't measure it.

Q. I believe you stated in your report, or else some of the witnesses have, that they worked 80 feet in the Crown Point?

A. I think it is stated in the report. I don't think there was any width of 80 feet open, according to my recollection. I should say not.

Q. Call it 60 feet.

A. It must have been something less than that.

Q. Do you think it would be safe in mining out 60 feet to allow the timbers to stand without filling in the space between the timbers?

A. Not for any length of time.

Q. It has been claimed here that, with proper ventilation, the timbers in a mine would last very much longer. When these spaces are filled up, which you say is necessary and prudent, can there be any ventilation, so as to preserve the timbers?

A. Not those timbers; I don't think it would affect those materially.

Q. Either little or more fresh air would not affect them?

A. I don't think it would produce any particular effect.

Q. Well, now, taking the working maps that are in this atlas, is it either possible or desirable to have these all ventilated from the tunnel level to the surface?

A. It isn't necessary to ventilate all that is represented there at one time at all.

Q. After the level has been worked out?

A. There is no necessity for further ventilation, simply because they don't use it. They fill it up in order to give a permanent support. It is somewhat equivalent to replacing what they have taken out.

Q. Then it is almost an abandonment of each level as it is worked out?

A. It is an abandonment, as I understand it.

Q. Don't you think that with increased power and larger-

sized blowers than are now employed there, the mines, to the depth of the tunnel level, can be sufficiently ventilated to make the working of men in the mines economical?

A. I have no doubt, if it is done regardless of expense, ventilation can be made as perfect as can be desired.

Q. How much more would be the expense than at present?

A. That I cannot say. I should think it would not be very much greater. The superintendents of the mines say it costs scarcely more to ventilate one level than another by means of the blower, so that, in ventilating the same space, according to their statements, the cost would be about the same for each the 1,000-foot and the 2,000-foot level.

Q. You spoke of the degree of heat last night that you found there, particularly in the Yellow Jacket—104° I think you said?

A. That was the highest that we found anywhere.

Q. That was in an abandoned cross-cut?

A. No, sir; it was in a drift on which they were then working—not at the head or breast where the miners were at work, but in that part which had to be traversed, in order to reach the point where they were working.

Q. I was mistaken about the point where you found that degree of heat. You spoke of having gone into a cross-cut at right angles with the drift, where the air was oppressive, did you not?

A. No, sir.

Q. Where the men were at work the thermometer was about 91° or 92°, you say?

A. It was over 90°, I think. It was 91°.

Q. What month in the year were you there?

A. We visited that particular mine on the 17th of July, 1871.

Q. That was supposed to be about the hottest season, was it not?

A. I should suppose it would have been.

Q. Now, as this air is taken down from the surface,

would it be very much warmer at that season than in the winter, when the air on the surface is cold?

A. I don't think the air at that particular point would change in temperature during the year. It might a degree or two.

Q. Suppose the cold air is taken from the surface down through that pipe?

A. The air was very stagnant, and it remained so for a long time. There was no current, and the heat which was shown by the air was no doubt communicated to it by the heat of the earth from the sides, top, and bottom of the drift.

Q. Was not the air warm at the mouth of the pipe, where you inhaled it?

A. I didn't try the temperature at that point, but it seemed to me to be cold.

Q. Cool compared to that which surrounded it?

A. Yes. Of course I could only judge by comparison, but it seemed to be cool.

Q. Was there any inconvenience, so far as you could see, in working, from the height of the thermometer at that point where this fresh air was coming in?

A. There didn't seem to be, so far as the men were concerned.

Q. Did they, or did they not, complain of the heat?

A. They did not.

Q. I believe you said they told you they preferred working there to working on the surface?

A. It was not these particular men, but it was in another portion which seemed to me to be nearly as hot, although I did not take the temperature at this second point.

Q. Of what advantage for ventilation can the tunnel be below the tunnel level?

A. I don't see that it could be of much on the natural ventilation.

Q. It ain't likely that the air, if the air should come in from the mouth of the tunnel, would descend into the workings below the tunnel level?

A. Not if it were allowed to go to the surface; I should think not.

Q. Now, of what advantage to the Sierra Nevada can the tunnel be in the way of ventilation?

A. It could be so arranged, if desired, as to carry all the ventilation of the tunnel to any one mine.

Q. Isn't the Sierra Nevada working? I am talking now about the Sierra Nevada.

A. In its present condition?

Q. Yes, sir.

A. Then I might change my answer.

Q. And as low down as they found any ore?

A. I didn't go into the Sierra Nevada at all, inasmuch as they were working near the surface, as represented. How far it had gone down I do not remember.

Q. They are working there through a short tunnel, are they not?

A. I think they are.

Q. Running the ore out above the top of the mill?

A. Yes, sir.

Q. Ain't that likely to give them all the ventilation they want?

A. It is all the ventilation they need at that level, or above. If they go lower they would have to establish other means of ventilation.

Q. The report of Mr. King, though, is to the effect that they have not found anything below to pay for working?

A. That I don't know anything about.

Q. You didn't go into the mine at all?

A. Didn't go in at all.

Q. You went into the Chollar mine?

A. Yes.

Q. More than once?

A. Only once.

Q. Do you know how deep they are working there? I have lost my last report, or I would show it to you. I had it here, but it is gone.

A. I have it down; none were more than 200 feet below the surface at the time we were there.

Q. How is that mine ventilated at present?

A. I believe by blowers, but I am not certain.

Q. Ain't there a tunnel running in there, through which part of the ore is taken right out without going up the shaft at all?

A. There is.

Q. Ain't there a great deal of the ore taken almost from the surface, or very near the surface?

A. I so understand it.

Q. You went into the Gould and Curry?

A. I did.

Q. On page 8 of the last report the superintendent says, that

"During the year two compartments of the shaft have been sunk 294 feet, making the entire depth 1,485 feet, or measuring from station A, at croppings, 1,685 feet."

That is nearly 300 feet in the year. Suppose the shaft to be sunk at that rate, how long will it take to attain to the depth of the tunnel level?

A. Less than one year.

Q. Do you know how deep the Savage is?

A. I do not remember how deep it is.

Q. I had a paper here the other evening stating that they had 50 feet to go to get down to the 1,500-foot level. It is a description of the mine and the present workings, given by a reporter of the TERRITORIAL ENTERPRISE. Do you know how far below station A the top of the Savage mine is?

A. I remember none of those numbers at all.

Q. Here are the figures.

A. Down 213 feet.

Q. But you have to go very far then, to be at the tunnel level?

A. It would be 1,700 feet and something.

Q. About 1,900 feet is the tunnel level, you state in your report?

A. It is 1,900 and something.

Q. No, it is a fraction under. It is only a foot or two.

A. Well, then, less than 1,700 feet, or about 1,700 feet.

Q. I believe the question is, how far will the shaft have to go still, in order to reach the tunnel level?

A. That depends upon its present depth.

Q. That is 1,450 feet.

A. If we assume it is now down 1,450 feet.

Q. The exact depth of the tunnel level is 1,898½ feet.

A. It would be 237 feet.

Q. Do you know how deep the Crown Point is?

A. According to my recollection, it was 1,300 odd feet when we were there.

Q. In this connection I will just get you to look there, General, and see how much that is below, and see how much further that has to go, in order to attain to the tunnel level?

A. That would make it 117 feet.

Mr. SUTRO. I would agree here, Mr. Sunderland, that we will admit that some of these shafts will reach down to the tunnel level. It's no use to go into all these figures. We'll admit that. You went all over this once with Dr. Newcomb.

Mr. SUNDERLAND. I wanted to lay the foundation for a question as to whether it is probable, in your opinion, that these main shafts on the Comstock will be at or below the tunnel level before the tunnel can reach the vein?

A. Those in which they are now working generally will. The Ophir, at their rate of progress, will not. The Gould and Curry and the Crown Point, at their present rate of progress, will be at the tunnel level before the tunnel reaches it probably.

Q. The Gould and Curry, the Savage, the Hale and Norcross, the Belcher, the Yellow Jacket, the Imperial—

A. I don't know about the Imperial. They had stopped work on the Imperial when we were there.

Q. That is really deeper than any of them from the top of the shaft.

A. I don't think it is quite as deep as the other, and they had suspended work when we were there.

Mr. KENDALL. Will the construction of the tunnel make the work of mining at depth easier, more profitable, than it would be without the tunnel?

A. We made our calculations about the depth of the tunnel and stopped there, and to that point, under certain conditions, we thought that it was more profitable to work from the surface; that is, unless reduction works were established at its mouth and worked by water power. As to getting to a very much greater depth, I could not positively state, but my opinion would be in favor of the economy of working by the tunnel after you get 2,500 feet, say from the surface, from the initial point.

Q. That is 500 feet below the tunnel level?

A. About 500; perhaps less.

Mr. SUNDERLAND. I understand you to say in your report, and you have intimated the same here, that the value of the tunnel depends upon the practicability of getting a sufficient water power at the mouth of the tunnel to reduce all the ore from the Comstock, and then to introduce machinery for concentrating the ore, so as to work it more cheaply. Suppose there should be a failure in ore in either, will the tunnel be then of any special value to the Comstock?

A. The commission have stated in their report that, in case both these should not be secured, our opinion would be in favor of continuing the work after the present mode.

Q. Do you know anything about this machinery for concentrating gold and silver ores?

A. I do not personally.

Q. Do you know what it would cost to work ores by that mode?

A. I have no idea further than was explained in the report and statements from different individuals, and from articles in certain papers, mining and other journals.

Q. Do you know what goes to make up the cost of reduction of ores now on the Comstock?

A. Not entirely. There is the cost of milling.

Q. I am talking now about the cost of milling—the reduction of the ores after they are delivered at the mill.

A. First, there is the crushing, then the stamping and the use of the quicksilver; the quicksilver is used, and a part of it is lost.

Q. Do you know about what the loss of quicksilver is per ton?

A. I have it somewhere in my notes.

Q. It is about $1\frac{1}{2}$ pounds on the average, is it not; perhaps a little less?

A. I think it is a little less, but I don't carry these things in my mind.

Q. It depends upon the grade of the ores, very much. Poor grade ones don't cost so much.

A. I have down for the Occidental mill the loss of the quicksilver about $1\frac{1}{2}$ pounds per ton of ore.

Q. Do you know what quicksilver is worth?

A. It is stated at about 80 cents per pound.

Q. That would be at a loss of \$1 20 per ton.

A. Yes, sir.

Q. Do you know what labor is in the mills?

A. I am not positive, but I think about \$3 50 a day, a little less than in the mines. However, these are all details that I did not look into. It was not considered as a part of our investigation in any way. Questions were asked more for general information than anything else.

Q. Mr. King gives the average at \$4 50. That takes in the superintendents, engineers, and all.

A. I don't know what the average would be at all.

Q. The amalgamator and the skilled labor—

A. I couldn't tell you what the average would be.

Q. Are not all the materials used in and about a mill much higher there than they would be on this coast or in Germany?

A. Undoubtedly.

Q. The machinery of every kind?

A. Undoubtedly. Cost of transportation and everything.

Q. Do you know that portion of a mill that wears out most rapidly and has to be replaced?

A. I do not.

Q. Do you know anything about the wearing out of shoes and dies of the stamps?

A. I should think they would be the parts that would wear out oftenest.

Q. Do you know how often they have to be replaced?

A. I do not.

Q. Do you know the cost per pound of shoes and dies?

A. I haven't the slightest idea.

Q. Do you know whether it is practicable to obtain the water power in the Carson river, so as to divert it and take it to the mouth of the tunnel?

A. I can only state exactly what is given by the commission in its report. I can read that if you desire.

Q. Well, I expect the members of the committee have read that. I don't know that it is worth while to repeat it. Do you know whether or not all the water power in the Carson river, from the first fall in the valley to the last fall at Dayton, is not now private property?

A. I so understand it.

Q. That property is owned generally, is it not, by parties interested in the Comstock?

A. A part of it certainly is. The Crown Point owns two mills there, I think.

Q. Do you know of any mills on the Carson river anywhere that are not owned by parties who are largely interested in the Comstock and who oppose the Sutro tunnel?

A. Some of these mills are owned by what is termed the Union Mill and Mining Company. What parties constitute the Union Mining Company I do not know. I know one of the individuals, and only one, and I suppose that he is largely interested (he is reported to be) in the mines themselves.

Q. Do you think it probable that the owners of these

water-rights upon the Carson river would surrender them, in order to take the water out and lead it to the mouth of the tunnel?

A. If it paid sufficiently for it, I think they would.

Q. Did you make any estimate of the value of the water-rights and the mill property upon the Carson river?

A. I don't know that I could call it an estimate. We obtained it from Mr. Sharon, who was represented to us as having more to do with the Union Mill and Mining Company than any other individual. He was the president of the company, I believe.

Q. He isn't an officer in the company at all, but still he has more to say about it than anybody else.

A. I supposed from what he said that he was president; but I don't know. We obtained from him his valuation of the mills. I didn't consider it of much importance, but we took it down.

Q. Did you visit the Eureka mill, in process of construction, while you were there?

A. It had not been commenced when we left. They were proposing to build it, unless I have confounded the name.

Q. Do you remember the Santiago mill?

A. I do.

Q. It was the first mill below that. There were two mills on the same mill site. I suppose they had commenced work when you were there. Indeed, I am quite positive of it.

A. The mills, as we had them down, as obtained by the commission, were, first, the Mexican, owned by Jones and Hayward; second, the Carson, just west of Carson, near the wood-flume belonging to the Union Mill and Mining Company; the Yellow Jacket, below the Mexican, Jones and Hayward; the Brunswick, below the Mexican, also Jones and Hayward; the Merrimack, below the Brunswick—the owners not given; the Eureka, about ten miles from Virginia City, owned by the Union Mill Company; the Vivian, below the Merrimack, owned by Sharon and

A. E. Head; the Santiago, ten miles from Virginia, by the Union Mill and Mining Company; the San Francisco—we have no items in connection with that.

Q. Well, that is abandoned. It's where this new mill is being built.

A. There's the Franklin, leased by Louis Janin; the Ophir, west of Birdsall's—no owner's name given; Birdsall's, which is a tailings mill, west of Dayton; Gammons, in Dayton, and the Rocky Point mill, one mile from Dayton, belong to the Union Mill and Mining Company, leased to the Crown Point Mining Company.

Q. Would not the construction of the proposed dam destroy all this mill property on the Carson?

A. All, probably, down to the Franklin mill; the most of the mills it would.

Q. If you take all the water power of the Carson river, of what value would any mill be below where the water is brought back again?

A. Nothing, except that they might retain their right to draw the water from the reservoir.

Q. I understand your proposition is to take all the water out of the Carson river and take it to the mouth of the tunnel?

A. Lead it to the mouth of the tunnel, or as much of it as is necessary.

Q. That is below all other mills, is it not?

A. No.

Q. What mill is below?

A. The proposition was to put the dam somewhere near the Franklin, or above.

Q. But you take all the water out of the Carson river, don't you?

A. Undoubtedly.

Q. Now you take it to a point below the Rocky Point mill, which is the lowest mill on the river, and that is above the mouth of the tunnel?

A. Undoubtedly.

Q. Now, I ask you of what value could that mill prop-

erty be anywhere on the Carson river, if you take all the water out of the Carson river?

A. The water could be taken from this race for those mills, undoubtedly. The water will be carried about three miles, and they could draw off any portion of the supply that they would be permitted to do.

Q. Then of what benefit would the tunnel be to those mills, if they are to be run as they are now?

A. I don't think it would be any.

Q. Of what benefit would the tunnel be to the Comstock, if all the mills on the river are to be run as they are now, or by taking water from this race that you speak of?

A. None, except that these mills would be a substitute for mills of the same capacity at the mouth of the tunnel. However, the idea would of course be to obtain all these rights.

Q. I understand your proposition to be, to reduce all the ore at the mouth of the tunnel?

A. That is our proposition.

Q. Well, that would destroy all the mill property on the Carson river, would it not?

A. Yes, this dam would destroy all the mills now above it.

Q. Would it destroy the Mexican mill?

A. I think it would. It would have no fall: that would depend, of course, on how high they dam up the water.

Q. Well, commencing at that Mexican mill, what amount of ground is there attached to it for the purpose of saving tailings and slime?

A. As I recollect it, there is a considerable amount of ground about it.

Q. Several hundred acres, ain't there?

A. I should think so.

Q. Is there any practical obstacle in the way of attaching to that mill machinery for concentrating and working the ore at the mill, instead of at the mouth of the tunnel?

A. None whatever, excepting the want of water.

Q. Would there be any more water at the mouth of the tunnel than there is at the Mexican mill?

A. Undoubtedly.

Q. How so?

A. Because a considerable of the surplus that now passes over the Mexican dam at high stages of the stream would be retained, and held and used according to the necessities of the mills. At the time we were there, a portion of the Mexican mill was hung up for want of power.

Q. Yes, sir; the greater portion.

A. At other seasons of the year there is a very large surplus of water. The object of the reservoir spoken of is to store up this surplus of the wet season for use in the dry.

Q. When you were there, did you hear anything about a project of constructing dams to form reservoirs in the mountains in a number of places on the head-waters of the Carson, for preserving the water there until the dry season came on?

A. I did not.

Q. What do you think of the feasibility of that?

A. I never examined the country, and therefore I couldn't give any answer which would have any value whatever. If the valleys lend themselves favorably, of course it could be done.

Q. Wouldn't it be more favorable to preserve the water in reservoirs on the mountains than in the valley, supposing the formation of the ground to be such that you can make reservoirs there?

A. That is a question that it is impossible to answer without an examination of the grounds. It certainly is possible.

Q. Wouldn't it be much colder up there?

A. I have no doubt it would be colder.

Q. What is the great cause of evaporation in the Carson valley?

A. It is the dryness of the atmosphere.

Q. The heat of the sun is very great there, isn't it?

A. Undoubtedly; but it is more than that. According to my view, all the water of the Carson is absorbed by evaporation finally; that which runs down the stream and forms the lake—the river of the Carson; it becomes dry, or nearly so, in the dry season.

Q. And it is evaporation?

A. I think it is entirely evaporation.

Q. Wouldn't there be very great evaporation in this large reservoir that you propose to form with this high dam?

A. There undoubtedly would be, but not as much—

Q. Have you made any estimate, General, as to the amount of water that would be required at the mouth of the tunnel to reduce all this ore—these concentrators and this other machinery necessary to reduce ore in that way—and compared it with the amount of water retained in that reservoir, and do you know how long it would last?

A. No, I haven't, for I have no means of knowing how large that reservoir would be, excepting the report made by the Surveyor General of Nevada, which I should judge, from my own observations, was very far below the fact.

Q. Well, either from that report, or from your own observations there, how long do you think the quantity of water it is possible to collect in that reservoir would last, consuming what would be necessary to reduce all the ore of the Comstock at the mouth of the tunnel?

A. I think it would last through the whole season.

Q. If the reservoir, then, would contain sufficient water to run the mills necessary for the reduction of the ores on the Comstock, at the mouth of the tunnel, couldn't the same amount of water be retained in the mountains at the headwaters by the construction of a number of dams there?

A. It is, undoubtedly, possible.

Q. Is it not cheaper to retain the same amount of water there, if the ground is farmable, for the construction of these dams, than to build one immense dam?

A. That is a question which it is impossible to answer

positively. Where the commission supposed this dam would be was a narrow gorge, where the dam would have an inconsiderable length.

Q. I don't know whether I am sufficiently acquainted with dams to know whether you were up or down the river, or across the river.

A. Across the river.

Q. What length would that have?

A. It is stated by the Surveyor General, that at the point which he selected and measured, the length at the top was 837 feet.

Q. And 155 feet in height?

A. Yes, sir.

Q. Is that from the bed of the stream?

A. That is from the bed of the stream.

Q. Do you know anything about the bed of the stream—what it is composed of—at that point?

A. I do not, at that point.

Q. Do you know whether it is rock or quicksand?

A. The bed along that portion of the stream is generally rocky, and I presume that rock would be found immediately below the surface.

Q. Do you know what has been formed in the bed of other streams where dams have been constructed?

A. I do not.

Q. Were they reconstructing the Brunswick dam while you were there?

A. I saw nothing of the kind passing up and down the river.

Q. To construct that dam 155 feet high from the bed of the river, and going as deep as it may be to get to the bed-rock, as we call it, what depth of foundation would it be necessary to have?

A. That would be a matter of calculation. I never have made it.

Q. What pitch do you give to a dam of that height?

A. That is a good deal a matter of choice. I would make the slope towards the water a gentle one.

Q. Say 45°?

A. Probably so. I don't know whether it is worth while to go into the full explanation of the thing. You can give it, of course, any shape you please, and the different dimensions will vary as compared with each other. If you give it a less base, we must make it thicker at the top, and its particular outline—cross-section—will depend entirely upon the question of economy.

Q. Of what material is it proposed to build that dam?

A. Generally of rock, I think, obtained from the hills immediately on either side.

Q. So the proposition is to build it of mason work?

A. Not of masonry, but of rock, and to put a facing on the interior, which shall be water-tight or measureably so.

Q. How do you make a facing that will be water-tight, if you don't lay mason work?

A. We can lay a thin skin of any masonry, or it will be possible, in that part of the country, to build it of timber. It is fresh water, not subject to attack from worms, and as the facing would be always covered with water, it would last an indefinite period.

Q. What is the formation on either side of the river there?

A. It is generally volcanic rock, of a character similar, in general terms, to that found on the line of the tunnel.

Q. Have you examined the estimate made by General Day, or made any of your own, as to the cost of that dam?

A. I have not examined the estimate of General Day at all. We made an estimate before the report of General Day was received, in which we assumed a certain width across, which was considerably greater than is given in his report. What the cost was I do not remember, but my impression is somewhere about \$400,000. But the dam had considerably greater length.

Q. What is his estimate?

A. His estimate is \$200,000.

Mr. SHOBER. General, how far above the mouth of the tunnel is it proposed to construct this dam?

Mr. SUNDERLAND. About five miles or so, I think.

Mr. WRIGHT. About $5\frac{1}{2}$ in its windings. I should think the Franklin mill is somewhere in the neighborhood of it.

Mr. SUTRO. The windings give it $5\frac{1}{2}$ miles. Would you consider the figures given by Captain Day for his length of the dam too low?

Mr. WRIGHT. That I could not tell without figuring it.

Mr. SUTRO. He states it at \$200,000, I think.

Mr. SUNDERLAND. What do you think of his estimate of the cost of building a race or flume or canal?

Mr. WRIGHT. His estimate is \$50,000 per mile. It depends upon the ground entirely. The larger part of it could be built for very much less than that sum.

Q. Is the nature of the ground such there that you could make a canal at all?

A. I think so. In a large part of it you certainly can very readily, as readily as they build the present flumes to their mills. It only requires a wide, deeper cross-section, that is all. It would be like their ordinary mill flumes enlarged in width and depth.

Q. Well, the flume is understood to be constructed of timbers and planks?

A. We used the term in its general sense of a leader of water from a stream or a dam to a mill.

Q. Whether it would be practicable to build any conduit for this water in the earth without planking; that is what I want to get at.

A. An open canal certainly can be made there. It would have to be carried across either by an embankment over any ravines, or in a timber flume, as is practised there now for the single mills.

Q. Then I understand you to say that the success of this tunnel; as a practical benefit to the Comstock, depends upon your getting this water, and then concentrating ores at the mouth of the tunnel, so as to reduce the expense?

A. You have got to do both of those things. That was our conclusion.

Q. Would the tunnel practically be a failure, then, so far as the Comstock is concerned, without getting both?

A. As a measure of economy, it would, until a certain depth is attained.

Mr. SUTRO. Mr. Chairman, I would like to ask a question right here, if Mr. Sunderland has no objection.

Mr. SUNDERLAND. I have none.

Mr. SUTRO. General Wright, I would ask you whether your figures upon the comparative cost of working as they do at present, and by means of the tunnel, is not furnished upon the estimates of the superintendents of the Comstock lode?

A. Yes, sir.

Q. Supposing these figures are altogether incorrect, would that not alter your calculations in regard to it?

A. Unquestionably. They are based entirely upon the correctness of the figures as given in our report.

Mr. SUNDERLAND. With the same amount of water, or the same amount of power in the Carson river, could not the ores be reduced at the mills where they are now built, adding to them the machinery for concentration, as cheaply as at the mouth of the tunnel?

A. Before answering that question, I would like to know what is meant by the same amount of power?

Q. The same amount of power that you propose to get at the mouth of the tunnel.

A. I should think that the cost of concentration and reduction would not differ materially if they could command the same amount of power, but that would involve the transportation of the ore to these mills.

Q. I am talking now about the reduction of the ore after delivered at the mills.

A. Very well. That is the answer to the question.

Q. Now you have mentioned the cost; do you know the charges for the transportation of the ore through the tunnel?

A. The tunnel company are authorized to charge 25 cents per ton of ore.

Q. What, for waste rock or debris?

A. The same.

Q. What proportion of debris is there to the ore taken out of the Comstock?

A. That we stated could not be stated with any degree of certainty.

Q. There is a very large amount, is there not?

A. Yes; there is a large amount.

Q. Probably equal to the ore sent to the mills?

A. One of the superintendents, in his report, has stated that it equals or exceeds, but the exact proportion I could not give.

Q. Then the transporting of ore or debris through the tunnel would be about \$2 50 a ton on the ore?

A. The cost of transportation we have taken at \$1 25; but if you have as much debris, it would be \$1 25 more; and, if that is all charged to the ore, that would be \$2 50, of course.

Q. Now, do you know what the average of cost of transportation is from the Comstock to the mills?

A. After it is raised to the surface, I understand, by the railroad it is \$2 a ton; to some of the nearer mills it is less. It is given to us, I think, at from 75 cents to \$2, but to the mills on the Carson I understand it is \$2 per ton.

Q. About the economy of reduction of ores by water power and machinery for concentration, do you know what it can be reduced for at the mouth of the tunnel?

A. I do not.

Q. You don't know?

A. No.

Q. You don't know what it costs the mills now on the Carson river to reduce ore, do you?

A. I don't think anybody but the mill-owners know what it costs them and what their profits are. They pay the \$2 a ton for transportation. They get \$12 for milling, I believe, as a rule, of which \$2 goes for the transportation of the ore from the dumps after it has been raised to

the surface. For milling they get \$10. What their profits are I do not know.

Mr. SUTRO. I would like to know whether this is to be a cross-examination, or whether there is new subject-matter to be brought in by Mr. Sunderland. If that is the case I shall insist upon a re-cross-examination.

Mr. SESSIONS. Mr. Sunderland can pursue his own course, but if he introduces new matter, you of course can be permitted to cross-examine in reference to it.

Mr. SUNDERLAND. It is simply a question of whether Mr. Sutro has all the rights and I have none. You have stated, General, in your report, that the mills charge \$12 for transportation and reduction?

Mr. WRIGHT. The mills on the Carson do.

Q. Do you know whether that is the rule with all the mills?

A. It is stated in the reports of superintendents that other prices are paid in certain cases.

Q. Above or below that?

A. None above, so far as I know.

Q. Did you or not learn, while you were there, that ore had been reduced at an expense of \$8 to \$9 a ton to the mine? Did you hear anything about it?

A. You are asking me questions of things which I really don't know anything about. The superintendent of the Savage mine states in his report:

"The cost of milling ore has been, for the last year, \$9 95 per ton, average. This includes transportation, which costs from 75 cents to \$3 per ton, according to the distance."

The Hale and Norcross superintendent reports that

"This company has paid from \$9 to \$12 for milling its ore. The mills pay their own transportation, which is from 65 cents to \$1 10 per ton."

The Chollar Potosi, I think, paid \$12 all the way through. The superintendent of the Imperial and Empire mines reports that the milling was done at the company mill, at a cost of \$7 90, including hauling, which is 45 cents per ton.

Q. Now, General, in forming an estimate of the economy and advisability of reducing ores at the mouth of the tun-

nel, would it have been very important to ascertain what it now costs to reduce ore on the Carson river?

A. I have no doubt it would, if it were possible to do so.

Q. Wouldn't it have been very easy to ascertain what it did cost?

A. I think not.

Q. Did you ask for any information of anybody there about the cost of milling or mining that you did not get?

A. I cannot say that we did.

Q. You didn't ask any mill-owner what it cost him to reduce ore on the Carson river, did you?

A. I did not.

Q. Do you think that the charge made by the mill-owners to the mining company is a fair basis for the expense of reducing the ores, and therefore to make a comparison between the present cost of milling and what the cost would be if the ores were reduced at the mouth of the tunnel?

A. Our comparison was not made on any such basis. It was made upon the basis of cheaper milling and concentrating where a sufficiency of power could be commanded at all times. This was made, of course, in connection with the other advantages or disadvantages of the use of the tunnel, as compared with the present mode of mining.

Q. Then, as I understand you, the great advantage, so far as the removing of the mills is concerned to the mouth of the tunnel, is in the saving and economizing of the water in an immense reservoir, and retaining it there until the dry season comes off?

A. It is that in part, and it is in part in having your mills at the point at which the ore is delivered at the surface.

Q. But if the transportation of the ore through the tunnel costs the sum that you have mentioned, is it any cheaper to go through the tunnel than it is to transport it on the railroad.

A. Well, I cannot answer it any better than to give the

figures in the report. They state the matured views of the commission, and, I believe, each member of the commission, after undergoing patient investigation, and after all these points were familiar to all of us.

Q. If you add to the expense of the transportation of the ore through the tunnel that of transportation of debris and timber, lumber and miners, would it be any economy to work through the tunnel, rather than to pay the transportation on the ore to the Carson river and the mills where they now exist?

A. I cannot answer that any better than it is answered in the report. There are certain matters of expense, as, for instance, that of debris, which it is impossible to submit to positive calculation. As we have stated in our report, the amount of debris varies in the different mines, and in the same mines under different circumstances. When miners are working on a bonanza the amount of debris is inconsiderable; where they are prospecting it is all debris, and it would be very easy to say that the amount of debris in all the mines is equal to that of all the ore taken out in a year, or that it is twice as much, or three times as much, or a quarter as much: and I am no more willing to give one of those numbers than another.

Q. Now, General, I believe we have talked about ventilation as much as I want to. I will ask you about the matter of drainage. Supposing these main shafts, in all the principal mines on the Comstock, should be below the tunnel level before the tunnel reaches the Comstock, of what considerable advantage will the tunnel be in the way of drainage?

A. It will save the raising of water an average of perhaps some 1,650 or 1,700 feet, depending upon the level of the tops of their shafts.

Q. The value of that water, when raised to the surface, will be so much loss to the mining companies?

A. I should presume so; but it would be used by the reduction mills at the mouth for the very purpose it is used for now, as I understand it, to some extent.

Q. I am glad you mentioned that. I want to ask you now of what value would the water be in the Comstock that would be drained by the tunnel? Where could it be utilized, and for what purpose?

A. It could be used at the mouth of the tunnel for power, or for the various purposes for which it is necessary in the reduction and concentrating mills.

Q. Something has been said during this examination about the use of this water, found in the ledge at the tunnel level, for compressing air for motive power generally. Is the supply of water on the Comstock so regular or certain, as that it can be made of any practical use on that level for any such purpose?

A. That question cannot be answered positively. It would be subject to great fluctuations undoubtedly, and there would be that objection to its use; but that it might be used as a supplement to other power is of course possible; whether it would be economical or not is, of course, a matter that cannot be determined now or here.

Q. If you use water power or any other power for compressing air to be used on the tunnel level, you want that supply of power to be regular, don't you? Must it not necessarily be so?

A. It would be much better to be regular; and it might be so irregular as to make it not worth while to use it at that point, but to allow it to flow out at the mouth of the tunnel and use it there. That would be a question of dollars and cents.

Q. Well, there is no doubt it could be used at the mouth of the tunnel economically, but would you rely upon it as of any value for use in the mines?

A. That, as I said before, is impossible to say. It could not be relied upon as the only power for use in the mines, and it would be a simple question of dollars and cents whether it should be used there at all or not. If it can be used economically, they will use it; if it cannot, they won't. The amount of water can only be determined after they have reached the tunnel level.

Q. I believe you have stated, General, in your report, that the water decreased as you attain depth on the lode?

A. That seems to be the general opinion, and I have not the slightest doubt of it, in my own mind, from what I saw and learned there.

Q. Now, in the Sierra Nevada and Chollar, both of which I mentioned before on the question of ventilation, is there any water to be pumped or drained that would make the tunnel any benefit to them as they are now working?

A. None whatever, so far as I know. Certainly not in the Chollar; I believe not in the other.

Q. Where does this low-grade ore exist, so far as you know or are informed? You have spoken of large bodies of low-grade ore. I mean where is it—near the surface, or on the lower level?

A. Generally it is at what may be considered the upper level. It is not at the deep levels.

Q. Those levels are now drained, are they not?

A. So far as they have been yet worked, they are.

Q. There is no water there any longer to interfere with the working?

A. I saw none of any moment.

Q. Then, could the tunnel be of any benefit to the mines in the mining and extraction of these low-grade ores?

A. In many instances this low-grade ore has been already mined, and has been used for filling. So far as that is concerned, the tunnel will be of no use for drainage; but there are some portions, as I understand, that have not been mined at all, or have been passed over as not now worth the mining; but in the process of mining these, pockets may be struck, and a large amount of water let into the mines.

Q. Do you know how long the Chollar Potosi has been mined without pumping?

A. It is stated, I think, by the superintendent in the report. I would prefer to refer to that, rather than to give my own memory.

Mr. SUTRO. It is not disputed at all that there is no

water in the upper levels. It all finds its way to the bottom. There couldn't be any water here. It goes down to the bottom of the shaft.

Mr. WRIGHT. His answer in reference to the cost of pumping is, that for two years last this mine has been entirely exempted from pumping.

Mr. SUNDERLAND. Now, is there any water in that mine where it is being worked?

A. None of any moment.

Q. No water pumped out of the shaft?

A. No pumping at all.

Q. Then, if you were to stop work on all the mines on the Comstock, would the water rise to these upper levels, where the low-grade ore is found?

A. That I cannot say. I should suppose after a very long time it might.

Q. It hasn't risen for two years in the Chollar mine?

A. It has not.

Q. Did you hear anything when you were there about a project of bringing water in from the eastern slope of the Sierra Nevadas?

A. I did not; or perhaps I should in answer to that say, that Mr. Sharon spoke of bringing water from some place—which, as I understand, was the Washoe lake—by means of pipes.

Q. The proposition is, to bring water from different lakes and from a stream which is called Franktown creek, by means of a reservoir on the eastern slope of the Sierras, considerably above the level of Virginia City, in an inverted siphon?

A. Oh, there was a project for bringing water to Virginia City.

Q. That is what I am talking about. Suppose that water to be brought in there now, could not the water be used for the compressing of air and sending it down the different shafts to any levels, and then be used afterwards at the different hoisting works, by the two towns of Virginia City and Gold Hill and by the mills in the neighborhood?

A. You couldn't use it but once on the same level.

Q. I was talking about using it as power on the surface?

A. Yes.

Q. Then saving the water and using it for these other purposes?

A. It would, so far as it would go, of course.

Q. Supposing you bring it on Mount Davidson, 200 feet above the different shafts?

A. But you don't want to bring it up there. It depends upon what height you bring it from. In bringing it over, they will undoubtedly bring it over the lowest point they can that is higher than the town; and they get then the pressure of the water from the head from which it comes; but, by going over a greater height, you get no more pressure. The pressure depends upon the difference in the levels of the entrance of the water and its delivery, when carried in pipes.

Q. I am supposing now, General, that it will be brought in there and emptied in a reservoir on the side of Mount Davidson, and then be used as a power to compress air and send it down the different shafts. It don't use up the water again, but it may still be retained at a sufficient height to use it for the different hoisting works and for the two towns. Is that practicable?

A. My answer would be a snap judgment entirely. I should not suppose it would be, in an economical point of view, to bring water in that way in pipes, and in sufficient quantity to fill a reservoir, to supply all those wants.

Q. Is there any cost in bringing the water after the first construction of the works?

A. None whatever but keeping them in order.

Q. Do you know the estimated cost of bringing that water in?

A. I do not remember. It was stated by somebody there, but I have forgotten entirely what the estimate was. I know it was further spoken of as a project that probably would not be carried out, but whether that would be so or

not I do not know. It was that it would not be carried out on account of the cost.

Q. Did you hear \$400,000 or \$500,000 mentioned as the cost?

A. I don't remember. I should think it was a good deal more than that. The water was to be brought for the use of the town, as I understand it, simply to supplement their present supply.

Q. What is the water used for there now, generally?

A. For all the purposes of life.

Q. It supplies all the hoisting works, don't it?

A. No, sir; not all.

Q. What hoisting works are now without it?

A. They use what they pump out, in part.

Q. Do you know how many steam mills are run by that water?

A. I haven't the slightest idea.

Q. Ain't those in Seven Mile cañon under that Water company?

A. I suppose they must get their supply from that Water company, except what they get from pumping and what they purchase from other mills. Some of these mines produce more water than they can use, and they can sell it out to other mills.

Q. Don't that Water company run all the mills now in the cañon, from Gold Hill down to the lower end of Silver City?

A. I don't know. Most of them were not running at all when I was there.

Q. Don't you think it practical, General, to place engines, to be operated with compressed air, at a depth of 2,000 or 2,500 feet below the surface?

A. Undoubtedly. Your receiver is there; your power is manufactured at the surface, and forced down into these shafts.

Q. Wouldn't that afford ample air for ventilation in the mines where it is necessary to have it?

A. It would, undoubtedly.

Q. How much farther, then, could you get?

A. As far down as man can go.

Q. That is a little uncertain, I suppose?

A. I believe so.

Q. Did you state, General, what per cent. would be gained in the ability of men to work if the vein were improved beyond what it now is?

A. I did not.

Q. I believe you were not able to arrive at that?

A. I was not able to arrive at any percentage?

Q. In your opinion, as expressed in your report, you think there is a possibility of striking other mines on the line of this tunnel, do you not?

A. I think there is a possibility, certainly.

Q. Any probability?

A. That is a question I cannot answer. I do not see any reason why they couldn't strike other veins. Veins show themselves on the surface. They seem to be large.

Q. How many veins did you see there between the mouth of the tunnel and the Comstock?

A. Three.

Q. What were they?

A. The first was the vein in which the Solferino mine is situated.

Q. That is the nearest to the Comstock?

A. Yes. The next was the Monte Christo, on which was situated the Occidental and the St. John's, and sundry other mines. And the third we have down as the claims that we examined, formerly worked by Dr. Buncher. It is east of the Monte Christo.

Q. What value do you think there is in any of these veins? Did you see any evidence of any value?

A. Oh, yes.

Q. What?

A. One running from the Solferino mine, which they were then working, and one in the St. John's mine.

Q. Who was working the Solferino?

A. I don't know who it was.

Q. How much ore were they getting out?

A. Very little. They were working in a rude way.

Q. How wide was the ledge?

A. That I don't know. I didn't inquire particularly about it.

Q. You didn't go down into it?

A. No, sir.

Q. Do you know whether it was six inches wide or twelve?

A. I don't know how wide the vein was, but there were indications of the general lode upon the surface.

Q. They got some rich assays out of that. It has broken every man that ever stuck to it long enough.

A. They were hoisting up ore and testing it, and they got out the gold first.

Q. They got some very rich assays from that. Now, about the Occidental. That is on the Monte Christo. Were they working that?

A. They were not.

Q. Do you know anything about its value?

A. I do not. It was sold out some time ago, and was purchased by Colonel Fair. Perhaps some others were connected with him. He told me, with others, that he was going to work it again.

Q. He didn't want the tunnel to meet it, did he?

A. He didn't say anything about it.

Q. Don't you know it is very much poorer on the level of the lower tunnel than it was above, where it was worked?

A. No; I don't know positively.

Q. Well, it is not worked at all on the level of the lower tunnel?

A. It isn't worked at all at the present time.

Q. It never has been. How much space?

A. No very large space. There were some stopes in the lower tunnel, according to my recollection.

Q. What was your information as to whether it would pay at all?

A. My information was that it had not paid, for the company had sold it out.

Q. The Solferino has sold out too, I suppose?

A. I don't know. I will say that the people of Gold Hill and Virginia City have no confidence in anything but in the Comstock. It would be hard to induce them to put money in that mine.

Q. Do you know why Dr. Buncher has stopped working his mine there?

A. I understood he had a very small capital, and that he was driven out by water.

Q. Speaking of this tunnel as an exploring work, of what considerable advantage would it be to any of these veins, or to the Comstock, to run a single drift at right angles across the vein?

A. It would enable an exploration of these veins to the right and left, at comparatively small expense, at a great depth.

Q. Did you go into the lowest tunnel running into the Comstock?

A. I think we did; if I recollect aright it was in the Gould and Curry. There has been a cave-in in General Van Bokelen's; there had been a cave-in in it, and he was not willing to enter it himself.

Q. Do you know what was the information upon the question of that ever having developed anything?

A. I understood it had developed nothing. They passed through the vein at a barren point.

Q. Then you think it very possible, General, to run through a vein like the Comstock with a single drift without encountering any ore at all?

A. The chances are that you will pass through a barren spot, as the barren portions far exceed the ore-paying portions.

Q. I will ask you as to the character of these superintendents with whom you came in contact while you were there?

A. Well, I considered them as entirely reliable men,

men of a high order of intelligence, and I was satisfied that the information they gave us, so far as facts were concerned, was correct, or as nearly correct as they could make it. They believed it to be correct. As far as their opinions went we did not always agree with them, as shown in our report.

Q. Are not the books of the different mining companies kept in such a manner that they know, by reference to them, all the facts that they pretend to state in their reports?

A. I so understand it. The books that we looked at were kept in great detail, much greater than I had expected to find.

Q. What have you to say as to their skill in mining and conducting the business of the companies which they control?

A. They all appeared to me to be able men, and I have no doubt they conducted the business as economically as they well can, and to the satisfaction of the companies, or they would substitute others for them.

Q. What was your opinion as to the mode of their mining? Did you have any improvement to suggest upon the present mode of working the Comstock?

A. Well, I suggested the use of compressed air to a certain extent, and the use of machine drills in the place of hand drills.

Q. Both those improvements might be introduced without running the Sutro tunnel, might they not?

A. Of course they could be used in either way of operating the mines.

Q. What kind of drills are used in the Sutro tunnel?

A. When we were there they were conducting their operations on a small scale, in the same manner in which they were conducted in the mines.

Q. In the same manner and with the same kind of drills?

A. Yes; hand drills.

Q. Double drills—that is, one man holds a drill, and the other strikes?

A. As a general rule, yes.

Q. There has been a question raised here as to whether there was sufficient capital on the Pacific coast to operate these mines. Did you see any evidence of want of capital there for any purpose?

A. I did not; but I don't know the amount of capital on the Pacific coast, of course.

Q. Well, at Virginia City or Gold Hill?

A. I saw no evidence of want capital either there or in California.

Q. Did you observe any evidence of any such jealousies between different mining companies there as to interfere with the effective and effectual working of the mines?

A. I cannot say that I did. I thought, as a general rule, they worked together whenever it was for their mutual interests. In certain cases I know they did.

Q. Sometimes where they did not like each other very well?

A. I think very likely. Their interests generally control them.

Q. The accuracy of these reports has been attacked, and particularly the report of Captain Day. Have you any reason to doubt the accuracy of his report, as far as he gives the cost of pumping and the cost of drifting and sinking of shafts?

A. I have not.

Q. Will you state now whether there is any difference in cost of raising a ton of water, by pumping or otherwise, and a ton of ore?

A. There must be a great difference ordinarily.

Q. Why?

A. In pumping, the power is in constant action; water is constantly being raised. In the other case it is done intermittently. The application of power to the raising of ore in the different mines is not, as a general rule, as economical as in pumping; and, as explaining the first part.

of my answer, I would say that the expense of raising 500 tons a day by hoisting, or 100 tons, is not as one to five.

Q. About what would be the difference?

A. That I could not give in figures; but as many engineers, firemen, &c., have to be employed for 100 tons as for 500. They must have the same power. They may have less boiler capacity, but they must have the same power to hoist 100 tons as 500.

Q. Will there be any difference in the cost of raising 600 tons per day and 100, except as to the consumption of fuel?

A. There will be something in the wear and tear, besides the use of oils, &c.

Q. That would be inconsiderable, though, would it not?

A. Yes, compared with the other cost.

Q. What quantity of ore do you think would be hoisted in twenty-four hours through two compartments in a shaft by a double cage?

A. I have no means of knowing. About 250 tons of ore is as much as they generally raise; but if so much could be delivered, I should think they could hoist 600 tons through two compartments.

Q. You refer to Mr. Atwood in your report, General. Do you know what position he occupies in the Comstock?

A. The information in reference to Mr. Atwood was obtained entirely by a single member of the commission, not myself. As I understand it, he is now on the Eberhart mine, in White Pine.

Q. Where do you get that information from, that he is on the Eberhart?

A. It was obtained from one of the members of the commission, who saw him and had the interview. I did not see him myself, and could say nothing as to personal knowledge.

Q. He was working the Eberhart in San Francisco, was he not, when that information was obtained?

A. That is more than I can say.

Q. Well, that was obtained in San Francisco?

A. That is more than I know.

Q. Was any member of the commission at White Pine?

A. No.

Q. The Eberhart is at White Pine?

A. Yes, sir.

Q. Then the information from Mr. Atwood was not gained at White Pine?

A. It was not gained at White Pine. I am not sure whether it was gained at Virginia City, or San Francisco, or New York. My impression is that it was got at Virginia City or Gold Hill, but I am not certain. The information and notes were brought to us by Dr. Newcomb, who met him. I did not see him, and I think General Foster did not.

Q. There has been an attempt here, General, to discredit the present mode of working the Comstock, and to create a prejudice against the present owners of the Comstock, on account of their stock-jobbing, as one witness has said:

"When they have ore in the mines, they are generally worked for the benefit of the stockholders; when they have no ore, the mines are worked in San Francisco."

Do you know anything about that?

A. I do not. I have heard it stated there often, however, that stock was purchased in these mines not for purposes of investment, but for purposes of speculation, and that seemed to be the general idea. That is about all I know in reference to the management.

Q. It has been said that, when ore is discovered in a mine, the parties in control take advantage of the other stockholders and buy the stock. Do you know anything about that?

A. I cannot say that I do. There was one instance in which it was supposed that a strike had been made in the Belcher, and one individual connected with it, as soon as he heard of the strike, purchased stock; at least he informed me that he did; and he informed me next day that he had lost money on it.

Q. Were you in the Belcher?

A. I did not go into the Belcher at all.

Q. Don't you know that that body of ore was found in the Crown Point, and then ran across the line into the Belcher?

A. It was supposed to be a continuation of the Crown Point. It proved to be a very small deposit.

Q. When ore is discovered, its discovery must necessarily be by running a drift or a shaft, or by sinking a winze, or by drilling?

A. Yes.

Q. Well, somebody has got to know that first, haven't they?

A. Certainly.

Q. Anything unnatural in the first man that finds it not buying stock?

A. I don't see anything unnatural.

Q. Is there anything wrong in it?

A. I don't know that I would like to give an opinion on a moral question. Men will do it. I rather distrust my judgment on such points.

Q. Well, supposing this thing to be wrong, and all these men who control the Comstock to be great rascals, as Mr. Sutro claims, do you think the moral influence of the tunnel would do away with all that? Wouldn't you discover the ore in the tunnel in the same way, if the tunnel were in, as now?

A. I do not see why not, exactly in the same way, and why there would not be the same advantages taken by somebody; and I do not see why not by the same parties.

Q. If the parties who now control the Comstock mines continue to control them, would the running of the tunnel effect any revolutions in that respect?

A. I don't see how it could. They will get the first information when they can.

HEARING SATURDAY EVENING, MARCH 2D.

Re-cross-examination of Gen. Wright.

Mr. SUTRO. General Wright, you stated, in answer to a question by Mr. Sunderland, that the draught between Crown Point and Yellow Jacket is very strong?

Mr. WRIGHT. I did.

Q. How far are these shafts apart, General?

A. I do not remember at all. It could easily be measured on the map, and the exact distance be found.

Q. The map gives about 600 feet?

A. I should suppose that would be about it.

Q. There is no difficulty in drifting a distance of 600 feet? In connecting these shafts each drift would have to go 300 feet?

A. Yes, sir.

Q. There would be no difficulty in extending such a drift every 100 feet of descent, every level they open?

A. At every level; no difficulty whatever.

Q. Now, supposing you wanted to explore the Comstock lode between two distant points, where there is no intervening shaft, say, for instance, between the Hale and Norcross shaft and the Imperial shaft, how would you go to work to ventilate that mine?

A. I should ventilate it by forcing air into the drifts by means of machinery placed upon the surface.

Q. That would then be artificial ventilation entirely?

A. Yes, of course.

Q. And very difficult ventilation?

A. I don't think very difficult ventilation. It would be purely artificial ventilation. I should not consider it as difficult ventilation, because the Sutro Tunnel Company have run their drift in about half a mile, and their working is by means of air forced in, and it is perfectly good air.

Q. General, do you know that there is any difference in driving in air horizontally or perpendicularly, when you use these force blowers?

A. There would probably be some more difficulty in getting it down to the level than there would be in running it horizontally.

Q. Isn't the resistance greater in the case of driving it down?

A. Certainly; somewhat greater.

Q. Isn't heat generated by compressing air?

A. As you compress air you of course generate heat, in accordance with a well-known law.

Q. Then it would be an exceedingly difficult thing to bring about natural ventilation between two distant shafts? The case of the Yellow Jacket and Crown Point would not apply there?

A. It would be impossible to establish an air connection, unless you had an absolute connection between the two shafts.

Q. If you want to ventilate a mine thoroughly, you have to make a connection at each level you open, say each 100 feet in depth?

A. Certainly.

Q. Would you consider it judicious or advisable to drift 3,000 feet at every 100-foot level, in order to bring about a natural ventilation?

A. If it could not be attained otherwise, you would be compelled to do it. These prospecting drifts naturally become ventilating drifts when connections are made. By operating from the surface, as at present, you must have artificial ventilation, in my judgment.

Q. Now, General, supposing that tunnel were constructed, and these drifts run along the lode, as is proposed to be done, and shafts extended down from the surface to the lateral drift, which would be greatly facilitated by having bore holes put down first?

A. Yes.

Q. Would it not be the rational way of working these

mines to put down a shaft, say at least every 1,000 feet, and then connect these, and thus bring about natural ventilation?

A. I have no doubt you would get much better ventilation in that way. I doubt, then, that I can give my views in answer to that question any better than they are expressed by the commission, in its report, and I should prefer to answer the question in that way. The commission says, on page 7, the second paragraph:

"It is therefore the opinion of the commission that, while the proposed tunnel would increase and improve the ventilation of the mines, and possibly dispense with the use of some part of the means for artificial ventilation now employed, it is not a necessity for ventilation. Even with all the aid that the tunnel can be expected to afford, it is the opinion of the commission that mechanical ventilation by blowers, operated by steam or other power, would still be needed at the headings and in the stopes where the air from the tunnel would not penetrate.

"According to natural laws, as at present understood and received, the air entering the proposed tunnel will pass through it and up the shafts of the mines, by the easiest and therefore by the most direct channels, thereby conferring little, if any, benefit upon the stopes and drifts not in the line of such direct transit. Hence the necessity which is assumed for a continuance of mechanical ventilation for certain portions of the mines after the completion of the tunnel."

Q. General, that answers the question in regard to ventilation to some extent, but that is not altogether what I want to get at. I want to get at your opinion in regard to bringing about such ventilation as you have seen between the Yellow Jacket and the Crown Point, which are 600 feet apart; and my question is, whether it would not be necessary to extend a number of these shafts down, in order to make these drifts between these different shafts at a great number of places?

A. I don't see the necessity of connecting the Hale and Norcross mine, for instance, with the Imperial.

Q. How would they explore all that part of the lode between the Hale and Norcross and the Imperial mine in depth from the surface down, operating from the surface, if they have not natural ventilation?

A. They must do it by means of shafts.

Q. Is it not economical, judicious, advisable to sink a shaft down every 1,000 feet along the lode?

A. I should say that, if it were determined to explore all the lode between the Hale and Norcross and the Imperial, it would be necessary to sink shafts at certain intervals, and probably not greater than 1,000 feet apart, probably less. It would be more economical to have them at even less distances apart.

Q. Would not the same principle apply in the exploration of that portion between the Gould and Curry mine and the Ophir mine?

A. I should say so, decidedly.

Q. Would it not also apply to all that part of the lode between the Ophir mine and the Sierra Nevada mine, or the Utah mine? Would it not be necessary, in order to explore the Comstock lode judiciously and intelligently, to sink shafts down every 1,000 feet?

A. Certainly, it would.

Q. Then, would it not be judicious to sink shafts similarly between the Crown Point mine and the south end of the Overman?

A. I don't recollect the distances there, but I should say generally, for a thorough exploration of the Comstock lode, operating from the surface, it would be judicious and economical to have shafts at intervals of say 1,000 feet.

Q. That is about the general idea, as an intelligent mining proposition?

A. I should say so, decidedly.

Q. Then, if those shafts are down, the difficulty would not be great in bringing about connections between them?

A. Certainly not.

Q. Provided that tunnel is in and these lateral drifts extended along the lode, will it not be much easier to make those shafts than it will be under the present system of working, by letting the water out below?

A. It would, to the extent of having the drainage performed by the tunnel without the intervention of machinery.

Q. Could not these shafts be constructed by going down from the surface, and going up from below, by making

accurate surveys, and connecting them in that manner, by getting two points of attack?

A. I would not like to answer that question.

Q. Do you see any difficulty about it as far as you know?

A. I wouldn't like to express an opinion upon the point. I never have given it any consideration. I should myself rather question the practicability of excavating a shaft of a given shape up vertically as easily.

Q. I did not say as easily, but I want to know whether it can be done?

A. Oh, I think it can be done. I think it is a possibility.

Q. I now want to get at your opinion with regard to the facility with which that shaft can be made—whether it would be as easy from the bottom or from the top?

A. I should say not, very decidedly. I think you would have difficulty in getting miners to operate upon a shaft of that kind.

Q. Are not all mining operations on the lode carried on in such a manner that they first sink down their shaft to a given level, then drift off to the vein, and then mine upwards to the next level above?

A. Yes.

Q. Do they not let the ore fall down to the level upon which they are working, and then convey it to the shaft, and hoist it up?

A. They do.

Q. Then, why should there be any difficulty in going up from the tunnel, in constructing a shaft?

A. I think there would be a great difference between the two operations of mining out a certain chamber and carrying up a rectangular hole of say 1,000 feet.

Q. What do you think would be the difficulty in the survey?

A. None whatever in the survey. I think they can be made to join with sufficient accuracy without any great difficulty. It would be the objection of the miners to

working in such a place, with such a mass of earth overhead.

Q. The danger of caves?

A. I think they would fear the danger of the rock falling upon them.

Q. Isn't there the same danger in those stopes?

A. I think not.

Q. The rock caves in sometimes?

A. Well, they can easily get out of the way there.

Q. Could they not make small chambers outside of that shaft, say two feet in, to stand in?

A. They certainly could do that; but that would be one of the difficulties.

Q. It would make a little extra expense. Do you know that, in the Harz mountains, they constructed a shaft, which they started at half a dozen different levels, and connected within half an inch?

A. I can understand that, if they all went down. There would be no surveying difficulties.

Q. Then, your opinion is, if there were shafts down every 1,000 feet, it would greatly facilitate mining operations and ventilation?

A. I should think so, certainly.

Q. Then, did you say that those shafts could be sunk much easier by having bore-holes down, first connecting with the tunnel?

A. Undoubtedly. You get rid of the water.

Q. Then that would relieve the miners of the greatest expense in making those shafts, because they wouldn't require machinery for pumping?

A. It would relieve them from one great source of expense, whether the greatest or not I cannot say.

Q. Then the tunnel would be very important in that regard, in order to thoroughly explore the Comstock lode and bring about this system of ventilation?

A. It certainly has its advantages for drainage, just to the extent of what the drainage would cost.

Q. Yes; but what I mean to say is, that it would facili-

tate the construction of these shafts every 1,000 feet to a very large extent?

A. Oh, undoubtedly.

Q. Then, after these shafts be constructed, there would be no further difficulty in bringing about ventilation between all these different shafts, and making a thorough exploration of the lode down to the tunnel level?

A. I think you would get a pretty thorough system of artificial ventilation in certain parts, wherever this connection is direct; but wherever you run off from this by your drifts, you must make use of artificial ventilation, whether that ventilation be operated from the tunnel level or from the surface above.

Q. All that I wish to get at in the questions I have asked, General, is whether, after the tunnel is in, the facilities would not be immensely greater for sinking these shafts, which would facilitate the ventilation of those parts of the Comstock lode which want exploring?

A. If they are to be explored, certainly.

Q. That is all, in regard to that subject. Mr. Sunderland has laid great stress upon the fact that there is no water in the Sierra Nevada mine or the Chollar mine near the surface. You stated that they were working near the surface, and he asked you, and also the other commissioners, whether you saw any water there. Now, is it very likely there would be any water near the surface, where they have got shafts down from 500 or 600 feet to 1,000 feet and more?

A. Well, I think there is no water here, simply because all the water that they have tapped has been drawn off already.

Q. Well, would not the water find its way in the Chollar mine down to this deep shaft? Would there be any water left in the upper part of that mine where they are working?

A. That shaft, in my opinion, would be very soon filled up. It is not absolutely impermeable to water, but I think the leakage would be a very small affair.

Q. I don't exactly understand your answer.

A. If there is any amount of water in the Chollar mine at any of the upper levels, it would be running into that shaft, and would soon fill up the shaft.

Q. Would it fill it up if there were mines again beyond that, where it could only rise to a certain height, and then run off into the other?

A. But that is not the case.

Q. General, supposing you had a common well 100 feet deep, with say 20 feet of water in it, and you would go to work and sink another well alongside, 20 feet deep from the surface only, would you consider it a most wonderful thing if there were no water in that 20-foot well?

A. It would depend entirely upon the character of the ground.

Q. Well, in ordinary rock, such rock as is on the Comstock lode?

A. I don't think the water comes from the rock at all. It would depend entirely upon where the water comes from into this deeper well. If it comes from the bottom, I should say the lesser well would not contain any water.

Q. Supposing it were any ordinary rock, could there be any water in a well 20 feet deep alongside another 100 feet deep?

A. If it were to fill up say to 95 feet in the deep well, it would be 15 feet deep in the lesser well.

Q. If there is 15 feet of water in the deep well, and you sink another well only 20 feet deep from the surface alongside of it, would it be probable that you would find water in the shallow well?

A. I must know something more about it; otherwise, there is no answer to the question. If the water stands at the height of only 15 feet in your well 100 feet deep, the source of that water is more than 85 feet below the surface.

Q. Couldn't any portion of the water come from the top down?

A. Undoubtedly; but it would fill your well to a greater

height than 15 feet. There is no reason why it should stop at a height of 15 feet.

Q. I simply wanted to illustrate the impossibility of having water in the upper working of the Chollar mine when they have a shaft down alongside of it which is 1,200 feet in depth.

A. I don't think that that follows at all. I think that if they made further explorations, perhaps, in the Chollar mine, they might strike reservoirs of water that never yet have been pierced.

Q. Wouldn't it run off into that deeper part?

A. It would until that deeper part filled up.

Q. Would that amount to any evidence about the non-existence of water in those parts? When you were asked whether you saw any water in the upper workings of that mine, you testified you did not.

A. My answer was, in answer to a question of fact, that there was no water there. According to all the statements we received in reference to the Chollar mine, water had been met with at the different levels as they went down. That water from each body they struck had been exhausted as they went down, and when they returned to these upper levels, after abandoning the lower part, they worked in a dry lode.

Q. You are now answering what I wanted to get at. Would it be probable, then, that they would find any water, at the time you were there, in those upper levels?

A. I think they may find it still.

Q. By drifting off?

A. Yes, and striking new bodies of water that have never yet been tapped.

Q. Were they making any new drifts in the Chollar mine at that point when you were there?

A. That is more than I can say. I do not think that they were prospecting. They were engaged in mining ore.

Q. We have shown here, and in fact the reports show it, that there is water, and sometimes a great deal of water, in the deep shafts. Mr. Sunderland has asked the question re-

peatedly, whether you saw any water either in the Sierra Nevada mine or the Chollar mine?

A. I have answered in reference to the Sierra Nevada mine that I did not go into it, and in reference to the Chollar mine, on the levels in which they were working, there was none, but in their deep shaft there was water.

Q. What I want to arrive at is, isn't it quite natural that there should be no water standing in that mine when there was a shaft alongside of it 1,200 feet deep?

A. The water won't stand there, of course. It will run into the deep shaft so long as that shaft has the capacity to retain it.

Q. Is there any wonder about it that you didn't see any water in that mine?

A. I don't think there is any wonder about it.

Q. That is what I wanted to get at. Isn't it quite natural that there won't be any water there when there is a deeper shaft beside it?

A. You spoke of the cause of the non-existence of water there, that they have a deep shaft. I say that it is because the water has been drawn off.

Q. Mr. Sunderland wants to show, by asking you a question about some mines, that there is no water there, but I want to know whether there could be any water there when there is a deeper shaft alongside?

A. I think there may be water still on that level of those mines. They may strike it yet in their search, if they continue prospecting.

Mr. KENDALL. I suppose, General, the point is this: whether or not these deeper shafts do not have a tendency to drain the more shallow workings?

A. They possibly may have, or may not.

Q. Provided the rock is sufficiently porous to allow drainage from the upper levels to the lower ones?

A. I don't think it is. The water doesn't appear to exist in that way. It exists in pockets or reservoirs surrounded by clay, which is impermeable to water. The moment the miners strike this clay, the water breaks out. I do

not think this condition of things exists where the rock is so porous as to allow the percolation of water through it.

Mr. SUTRO. Mr. Sunderland asked you, General, whether the tunnel would be of any benefit to the Chollar mine, where they are now working, and he asked you whether you saw any water, and your answer to that was, I think, that it would be of no use at the present time?

A. I should say it would be of no use for drainage, if there were no water in the mine. It appeared to be a very obvious answer.

Q. Then it is very important to know whether, if there be any water there, the water would go into the lower shaft?

A. It certainly would run into the lower shaft unless they stopped it from communication with that shaft and pumped it out.

Q. If the Chollar mine would want to prospect to greater depth than what their prospecting shaft is down now, would you consider that the tunnel would be of any benefit to the Chollar mine for drainage?

A. Certainly; it would be a benefit to the mine as well as to all others.

Q. Mr. Requa states, in his report about that mine, that all the ore which is in sight now would be worked out in three years. Would it take that long to get the tunnel in, or nearly that long?

A. About that.

Q. Then all the working of that mine would be prospecting afterwards?

A. If they continue to work it, it will be all prospecting.

Q. Would they have to pay anything to the tunnel company, in the way you understand it, if they are only prospecting, and not taking out ore?

A. Nothing at all; unless they carried out their debris for them, or brought in their timbers.

Q. Well, that is voluntary?

A. Undoubtedly voluntary; they are not compelled to.

Q. They wouldn't be compelled to pay a single dollar to the tunnel company?

A. No, sir.

Q. Then it would be, under those circumstances, very advantageous to the Chollar company to have that tunnel in?

A. I should certainly think so; for the purpose of drainage alone it would be of great importance to it.

Q. It is shown in the report of Mr. Batterman that the Gould and Curry shaft has been sunk 294 feet in the last year, and I think you were asked how long it would take to reach down to the tunnel level at that rate of progress?

A. I do not recollect.

Q. I want to ask you, General, how long do you think it took to get down to that level before they started on that 294 feet, say from the 1,100-foot level?

A. I have no means of knowing when they commenced at all.

Q. It took a number of years, didn't it?

A. I have no idea when they commenced that shaft.

Q. Took quite a number of years?

A. Oh, yes; two or three years, I suppose.

Q. They don't sink all the time, do they?

A. I don't think they do; that is my impression.

Q. Do you know, General, how deep the shafts were in the mines of the Harz mountains at the time the Ernst August tunnel, which has a length of 14 miles, was commenced?

A. I don't remember; I think some of them were down 2,000 feet or more.

Q. Well, they were down some 700 or 800 feet below the tunnel level before they commenced the construction of that tunnel. Then, General, these people there looked upon the advantages which a tunnel would confer as being entirely below the level of that tunnel?

A. They must have looked upon this tunnel as a new departure, I presume.

Q. In other words, a new basis of operations?

A. Undoubtedly; they so stated it.

Q. In fact they constructed that tunnel to pump the water from the lower depths to that level, and bring their ore in there, and they constructed a canal in it.

A. Yes; that tunnel has a canal, and all their water is raised to that level.

Q. Do you know whether the shafts in the Freiberg mines were much deeper than the Rotheshoeneberger tunnel, where they commenced it?

A. No, sir. I am not at all familiar with them, except in general terms.

Q. The mines were carried down to 2,000 feet, and the tunnel comes in at about 1,100 feet in depth, so they must have been down some 900 feet below the tunnel level?

A. I presume they were below the tunnel, although I do not remember now.

Q. Do you not so understand it that in England and in other countries, where mining is carried on on a pretty extensive scale, they calculate the depth of their shafts from the tunnel level down?

A. I think it is so.

Q. Then, according to that, we have not fairly touched the Comstock lode yet. We are going to establish a new basis of operations when the tunnel goes in. We are going down, and we are going to count down from that point?

A. I think, as the water and ore would all be raised to that height, they would undoubtedly count the depth from the tunnel level.

Q. Then what is above the tunnel would become really to be counted as surface?

A. Well, I am under the impression that they will prospect all above the tunnel before they will go below it.

Q. Do you think that the Comstock lode can be thoroughly prospected its whole length of four or five miles in 100 years?

A. Oh, I have no idea at all. I wouldn't be willing to give an opinion as to that. It depends entirely upon the

energy with which it is prospected and the money that can be got for the purpose. I think myself, from what I saw there, that there are certain parts of the Comstock lode, between the Sierra Nevada on the north and the Overman on the south, that will never be prospected any further than they have been already.

Q. Do you know that the Veta Madre of Guanajuato, in Mexico, has been abandoned, during the last three hundred years, a dozen times, and re-prospected and new bodies of ore found?

A. I knew that a good many of the mines in Mexico have been abandoned over and over again. They have been abandoned generally, as I understand it, on account of what they considered insurmountable difficulties. New machinery has been put in, and the mines have been worked again, often with great success, until the power of the machinery which they put up was exhausted, or until they had reached the limit of that power.

Q. Don't you think, General, that it will require hundreds of miles, or even thousands of miles, of drifts on that Comstock lode to thoroughly explore it from one end to the other down to the tunnel level?

A. To thoroughly explore the whole lode from the surface to the tunnel level would require, yes, thousands of miles of drifts, undoubtedly.

Q. They have probably hundreds of miles now?

A. I presume there are several hundred now.

Q. Several years ago the number was estimated at 75 miles. Then the tunnel would open up an entirely new basis of operations to go down, about which we know nothing yet—to which we have not yet penetrated?

A. If operated by the tunnel, certainly everything would refer to that level.

Q. Do you know anything about those great tunnels in Europe, whether the government took any part in them?

A. In several of the German tunnels, I know that the government took part. As I understand it, as a rule the

German mines are, to a certain extent, under the supervision and management of the government.

Q. To some extent; not entirely. The mines in Freiberg are owned by private individuals to a certain extent?

A. Yes; but the government has a certain amount of supervision or control over them; but what the extent of that is I am not prepared to say.

Q. Are you aware, General, that, in Freiberg, the erection of the reduction works has been helped by the government?

A. I do not know specifically about the reduction works.

Q. Do you know anything about the Mont Cenis tunnel, which is simply a railroad tunnel, whether government assistance was given there?

A. Government assistance was given both by France and Italy.

Q. Do you know anything about the Hoosac tunnel, in Massachusetts? Did they receive any any State aid?

A. I know the State has furnished a large amount of aid to the tunnel, and at the present time it has full control. The present amount, I think, is somewhere about four and five millions of dollars.

Q. Isn't the whole amount which the State of Massachusetts has advanced about \$7,000,000?

A. I don't know the amount.

Mr. SESSIONS. I think it is over \$7,000,000.

Mr. SUTRO. What is the object of the tunnel?

A. It is to establish railroad communication through the Hoosac range. It is a railroad running from Troy to Boston.

Q. It will cheapen transportation?

A. They assume that it will save the grade which exists upon what is called the Western railroad—I think the railroad from Greenbush to Boston.

Q. It has been stated, that the construction of that tunnel will reduce the freight on a barrel of flour two cents. Do you know anything about that?

A. I have heard such statements. I cannot vouch for the figures, as I have never entered into the calculations.

Q. Would you consider the Hoosac tunnel as of as much importance to Massachusetts as the Sutro tunnel to Nevada?

A. They are two different things that do not admit of a comparison at all.

Q. As far as interests are involved?

A. If that is an answer to the question, I take more interest in the Sutro tunnel.

Q. Well, is not the question of wealth that is to be created or developed—the question of the developing the mining regions—of immensely greater importance in the one case than in the other?

A. I think it depends entirely upon the view one takes of the matter. An opinion upon such a question is necessarily a speculative one.

Q. How much money, General, do you think would be taken from the Comstock lode. Have you any idea?

A. Not the remotest.

Q. Could you guess?

A. No, sir; I never guess.

Q. Do you think there is money enough there to pay the national debt?

A. I think there may be enough to pay it ten times over, or you may not find a dollar below the level they are working now.

Q. Do you think that is probable?

A. I do not.

Q. Don't you think it is probable they will find the ore down to indefinite depth?

A. I think so. The evidence, so far as it goes, is entirely in favor of that view.

Q. You have stated in your report that, if no water power be secured at the mouth of the tunnel and concentrating works erected, the commission could advise the continuance of the present mode of working. How did

you arrive at that result? Was it on the basis of the reports furnished you by the superintendents?

A. Undoubtedly. It is so stated in the report.

Q. Supposing it could be demonstrated that those reports are not correct, would it change your opinion?

A. It might, or it might not. I should have to make a new comparison, and, although discrepancies might be discovered, the judgment might be the same. But I can understand that it might be so changed that my opinion would be changed entirely.

Q. Supposing it could be shown clearly, to your satisfaction, that the cost of pumping on the Comstock lode would amount to more than \$1,000,000 per annum, would that change your opinion? You estimate the cost at \$124,000.

A. In certain calculations that we made, we assumed the cost at the present mode of operations to be a little over \$1,750,000. If it could be shown that the cost of pumping was over \$1,000,000, it would change that result to one favorable to the tunnel, instead of unfavorable.

Q. Supposing it could be shown to cost \$2,000,000?

A. It would be still more.

Q. Supposing there were still other items brought in, that would amount to several millions of dollars, wouldn't that change it very much?

A. Certainly; any change of a million or more would change it.

Q. Could you tell what becomes of the \$15,000,000 which are extracted from the Comstock lode per annum, while the expenses for hoisting, for transportation, for pumping, and for hoisting and lowering the men, is only given at \$1,000,000, and the average profit is only \$1,000,000, which make \$2,000,000? Can you tell what becomes of the other \$13,000,000?

A. Well, there are a great many other items of the cost of mining—the timbering, the reduction of ores, and all those things.

Q. Do you think that amounts to \$13,000,000 a year?

A. I haven't an idea.

Q. You didn't take that into your calculation?

A. Of course not. That was no part of the duty imposed upon the commission.

Q. You have stated, in reply to a question by Mr. Sunderland, that labor and materials are much dearer with us than they are in Germany? Isn't that another argument in favor of introducing self-acting reduction and concentrating machinery at the mouth of the tunnel?

A. Undoubtedly it is.

Q. You say that the water-rights are owned by the mines and private parties?

A. Yes.

Q. After the tunnel is in, and the mines would be worked legitimately and for the benefit of stockholders, wouldn't the stockholders insist on adopting the most economical plan?

A. I should suppose that they would always.

Q. Now, supposing the present owners of these water rights would be offered the same power at the mouth of the tunnel, wouldn't self-interest make them accept, according to all common reasoning?

A. I believe they will act according to their own interests.

Q. Are not men actuated generally by their own interests?

A. Undoubtedly.

Q. Supposing all the mills on Carson river would be given the same power at the mouth of the tunnel, would we not still have a very large amount of power for other purposes?

A. Yes, most unquestionably so; always provided that that reservoir is possible.

Q. Wouldn't that surplus power at the tunnel, after giving all the power which these people have, be sufficient to answer all the purposes of reduction and concentration and condensing air for the ventilation of the mines, and everything else, to work the Comstock lode?

A. Well, I think that the water that can be obtained from the Carson river and the drainage of the mines will be sufficient for all purposes connected with the Comstock.

Q. At the point which you examined there, on the Carson river, near the Franklin mill, would you consider there would be any difficulty in making a dam there?

A. I don't consider there is any difficulty in making a dam there.

Q. Couldn't a dam be constructed there that would withstand any pressure created by the water?

A. Most unquestionably.

Q. Well, do you see that there is any serious engineering difficulty in making that dam?

A. I should think not.

Q. Don't you, on the contrary, consider it a very simple and feasible undertaking?

A. The committee consider it a rather large thing, but not a difficult one at all.

Q. What do you think, General, would be the cost of the dam? Mr. Day states it at \$200,000.

A. It would be utterly impossible to say.

Q. Would you consider that an under-estimate?

A. My answer must be a mere guess. I should think it was an under-estimate.

Q. How much more, at a rough guess, should you think it would possibly cost?

A. I should prefer to increase it one-half.

Q. You think it would cost \$300,000, probably?

A. I should think so. That is a mere guess.

Q. It has been stated that it will cost 25 cents per ton a mile to carry out ore, or waste rock, to the mouth of the tunnel. Is that compulsory on the mines? Need they take their rock out that way?

A. They needn't take anything out that way.

Q. It is optional with them?

A. Entirely, as I understand it.

Q. Would you not consider it highly judicious for the

tunnel company to reduce that down to such a rate as would be acceptable, if it be considered necessary.

A. I should think, if it is necessary, in order that they should get business, they would reduce it down to any fair paying tariff.

Q. This is a maximum charge?

A. They cannot charge any more.

Q. But they can charge as much less as they please?

A. Undoubtedly. If they cannot get 25 cents, and can carry it at a profit for 10, then they would come down.

Q. Don't you think the tunnel company would reduce these prices, so as to make it advantageous to both parties?

A. I think they will do that which makes it most advantageous to themselves.

Q. Wouldn't that be to put down the prices to so low a rate as to bring about the largest transportation through the tunnel?

A. I think they will put down the rate so as to secure the business and do it profitably, but not one cent beyond.

Q. There was a contract between the tunnel company and the mining companies?

A. I know there was a contract, and I believe that the prices were named; in other words, I believe that, in the act granting franchises to the tunnel company, Congress adopted the tariff which was given in the original contract between the mining companies and the tunnel company.

Q. Congress ratified the contract?

A. I couldn't say that. They ratified the charges.

Q. Did the Union Mill and Mining Company give you the cost of milling?

A. We didn't ask the Union Mill and Mining Company any question upon the subject at all, and therefore they did not. We obtained their rates of charges from the different mining companies.

Q. Wouldn't the Union Mill and Mining Company charge all they could get?

A. I haven't the slightest doubt of it.

Q. They charge \$12 a ton?

A. I believe so, generally.

Q. And that is what the mines had to pay?

A. It is what the mines do pay for milling and transportation.

Q. Are you acquainted with railroad transportation?

A. Very little.

Q. Have you a general idea how much it costs per ton per mile?

A. That depends entirely upon where it is.

Q. In a pretty level country, where there is large transportation?

A. I don't remember exactly what it is.

Q. It has been stated here at a cent and a quarter per mile. Do you think that is about correct?

A. I should think it was more than that. My impression is that it is over two; though, on some roads, they perhaps may afford to carry it at far less.

Q. Well, call it two cents. You have stated the average distance at 5 miles from the mines to the mouth of the tunnel?

A. It is about that.

Q. Would it be possible, then, to carry ore at 10 cents to the mouth of the tunnel for the whole distance?

A. I should hardly think it would.

Q. How much should you think it could be done for?

A. My impression, when looking over the matter, was, that it might be carried for perhaps 7 or 8 cents, by the tunnel, a mile.

Q. We have some figures here by Mr. Carlyle, which show that it would cost 7 cents for the whole distance. Did you examine them?

A. There were a good many figures of Mr. Carlyle's which I did not adopt.

Mr. SUNDERLAND. Who is Mr. Carlyle?

Mr. SUTRO. Mr. Carlyle is an engineer—a man of great ability, a very thorough mechanic, and a first-rate man—who made a report upon the tunnel.

Mr. SUNDERLAND. He was employed to make your report?

Mr. SUTRO. He made a report upon the cost of construction of the tunnel.

Mr. SUNDERLAND. Employed by you?

Mr. SUTRO. Yes, he was our engineer. (To Mr. Wright.) Well, supposing it costs 7 or 8 cents a mile—did you say a mile?

Mr. WRIGHT. Yes.

Q. That would be about 40 cents?

A. Yes.

Q. Would you consider that it would cost 40 cents, if you carry 3,000 tons a day, take all the transportation of the rock and waste?

A. Well, this is very much of a guess. I don't attach much value to the amount, of course; but I should think it would.

Q. These mining companies at Virginia City sell some of their water. Do you know how much they get for it?

A. I do not. I haven't the slightest idea what it sells for.

Q. Do you think it is \$1,000 an inch?

A. I haven't the slightest idea.

Q. You didn't look into it?

A. I did ask the question, but I have forgotten the answer entirely.

Q. If a supply of water was to be carried down in pipes from the surface to supply these hydraulic engines at the tunnel level, could there not reservoirs be constructed, as is done in Germany, within a number of miles from the mines, in the mountains, wherever the configuration of the country allows it, for the purpose of accumulating water in winter from rain and melting snow?

A. It could undoubtedly be done.

Q. Take a distance of 5 or 6 miles around Virginia City, in those ravines, could there not dams be constructed and large lakes of water formed?

A. Undoubtedly.

Q. Have they systems of that kind in all these mining districts of Germany on the most extensive scales—every drop of water that falls being collected and carried down in the shafts and used for power? Now, supposing that were done in Nevada, would it not create a very large power at the tunnel level?

A. Well, water enough could be collected in that way, added to the water from the mines, to furnish a very large power; whether it would be economical to do so is another question. Speaking of the mere possibility of it, it can be collected.

Q. What would be the principal expense about it, besides the construction of dams?

A. The expense of the dams is all, unless the land would be something.

Q. Would the land cost anything?

A. I don't know what it costs. I think it would cost, if anybody owns it.

Q. Does anybody own it?

A. That is more than I know. I think a good many would like to own it, if there were a prospect of selling to the Sutro Tunnel Company.

Q. Mr. Weissbach, in a statement read here yesterday, gave a power, with 50 gallons a second at a depth of 2,000 feet, of 1,800 horse power. Would you think there would be any difficulty in collecting water to that extent by the construction of proper reservoirs over there?

A. I couldn't answer that question. It depends upon the rainfall and a great many other circumstances, I should suppose so; but the answer is worth nothing.

Q. You would suppose there would be no difficulty. It has been stated here that the water in those mines decreases in depth. Do you not ascribe that, to a large extent, to the dry seasons which had prevailed for some years?

A. My own impression is, that the water which has been met with in the mines is the accumulation of long years.

A. I formed that impression there, and, if that be true, a

dry season or two would make comparatively little difference. It would be likely to decrease it somewhat.

Q. Does not the water which we find in wet seasons go down to a great depth?

A. In some places it does; in others it does not. A great deal of it runs out in the shape of springs and brooks and rivers.

Q. Would there be more water after a rainy season—a good deal—than after a series of dry seasons?

A. I should think there would be more.

Q. We have had a statement here about bringing water to Virginia City in pipes. Are you aware how that water is to be brought there?

A. It is to be brought by siphon pipes across the Washoe valley.

Q. Do you know what the elevation is from the Washoe valley across those mountains?

A. I don't remember.

Q. Would you think 1,700 feet would be an over-estimate of the height?

A. I have a sort of impression in my mind that it was about 1,300, but I may be entirely wrong.

Q. It would take a pretty strong pipe, wouldn't it?

A. Certainly.

Q. Supposing mining would be done through the tunnel, could that water not be employed very usefully by conducting it down to the tunnel level, and providing it for machinery for pumping and hoisting?

A. Most unquestionably.

Q. Could they get sufficient water at Virginia City for milling or concentrating purposes on the ore of the Comstock lode?

A. I cannot give any very definite answer to the question. If they can find a sufficient supply of water at a height above Virginia City, it can undoubtedly be led there.

Q. How much water do you think would be required to concentrate the ores of the Comstock lode properly?

A. I haven't an idea.

Q. Would you think they could bring Carson river up to Virginia City, or as much water in bulk as the average Carson river would furnish?

A. Certainly; with a sufficient number of pipes they could.

Q. From where?

A. They have got to find it, of course. They could tap Lake Tahoe, if it is high enough.

Q. Is it as high as Virginia City?

A. I am under the impression that it is represented as a little higher. They would have to get over some higher places.

Q. How much do you think it would cost to bring water from Lake Tahoe into Virginia City equal in volume to the Carson river?

A. I haven't an idea. It would take a great deal of money.

Q. Do you think it feasible?

A. I do not, in the sense of economy.

Q. You might as well try to bring water from the Rocky mountains into New York city, as far as economy is concerned. What size pipes did they propose to bring that water in; did you hear?

A. No, sir; I gave very little attention to it.

Q. They hadn't done anything about it?

A. Nothing at all, so far as I know.

Q. You visited the Lady Bryan mine, on the Flowery lode?

A. I did.

Q. Did you see large quantities of low-grade ore there?

A. No, sir, not large quantities. It was a very large lode at the surface; the ore was distributed over a considerable width; but it was a mine that had been opened from the surface. All the ore we saw, of course, was what was left upon the exposed surface.

Q. Supposing that a connection would be made with the tunnel, could that ore be dropped down and brought to the

mouth of the tunnel, and reduced there more profitably than now?

A. That I could not say. They have their mill immediately at their workings, and what their means are for obtaining water at all seasons I cannot say.

Q. Would they have water there for concentrating ores?

A. They had so much water in the mine, that they had stopped working the lower portions.

Q. They couldn't pump it out, could they?

A. They couldn't with the machinery they then had. They said they were about putting in powerful machinery for the purpose of draining the mine, but when we were there they hadn't yet done it.

Q. They have given up mining, on account of difficulties in getting down? We have bought their machinery, and it is now at the tunnel.

A. They were at work there when we visited the mine.

Mr. SUNDERLAND. I think it has been abandoned, because the ore wouldn't pay.

Mr. SUTRO. Under the expensive system they are working with. Did you say, General, that you saw the mine that Dr. Buncher owned?

Mr. WRIGHT. We passed it.

Q. What was the statement about it. Was there much water there?

A. It was stated that he was driven off by the water.

Q. If it were connected with the tunnel, wouldn't the water be drained off?

A. Undoubtedly.

Q. And allow him to prospect his mine?

A. Certainly.

Q. You have spoken of the superintendents over there as very excellent gentlemen, of great intelligence. Are they not rather selected for their sharp business qualifications than their qualifications as miners? Had any of them graduated at a mining school?

A. The first part of the question I cannot answer. None

of them pretended that they had had any education at a mining school, and many of them stated that they had not.

Q. Are they not as a class pretty sharp business men?

A. I should think they were.

Q. Very intelligent, smart, shrewd people?

A. I should say so.

Q. You were asked whether any improvements could be made in the present mode of mining. Would you not consider it an improvement to bring about more thorough ventilation than they have now?

A. Yes, I certainly should.

Q. If the tunnel were connected by a great number of shafts with all portions of the mines, would that not bring about more perfect ventilation than there is now?

A. I have no doubt it would somewhat.

Q. Wouldn't that improve the health of the miners?

A. I should think so.

Q. What do you think makes these miners over there all in favor of the tunnel? Don't you think they know something about mining—that they have a practical knowledge of mining?

A. I think they have a practical knowledge of the use of the pick, and I do not think that their knowledge goes much beyond that.

Q. You do not think they are men of intelligence?

A. I wouldn't say that they are not men of intelligence. I do not think that they have had the opportunities of knowing. I don't think that they are the men I should go to for special information on mining. As mining men, I should think their information would be of much value.

Q. Don't you think their interests should be consulted, as far as their health and their condition is concerned?

A. I should think it ought to be consulted by the mining companies.

Q. Should it not, in mining countries, be a subject of legislation, to compel mine-owners to carry out certain protective measure for the lives and health of the miners?

A. Certainly; it is in this country and many others.

Q. Isn't the opposition to this tunnel entirely confined to the managers of the mines over there?

A. So far as I know, the active opposition to it is.

Q. Mr. Kelley, of Pennsylvania, in a speech made in the House of Representatives, said:

"Gentlemen on the other side have spoken for the owners of the mines. I propose to speak for the miners, the men who with pick and shovel extract the ore, and forty-five per cent. of whom die of miner's consumption, which seizes them and penetrates their vitals before they are admonished of its approach, and who die in their youth, or, in the vigor of their young manhood, prostrated by the heat and poisoned by the atmosphere of these mines. These industrious men are subscribing to stock in the Sutro Tunnel Company; they swarm behind Mr. Sutro, and beg Congress to vest all the rights in him that will enable him to redeem them from the terrible doom to which these so-called miners' friends would still condemn them.

"Sir, I brought with me from one of these mines a bit of blackened ore, blackened by the smoke of a fire that smothered and burned forty-five of these men in the mine. Had there been a tunnel such as Mr. Sutro is constructing, they would have been breathing pure air while at work; and, though the lumber of the mine might have burned, the miners could have dropped below the fire and escaped. It is essential to the lives of the miners that better arrangements in the mines on the Pacific coast, and in the coal mines of my own State, should be made, and our Legislature is perfecting a law to compel their construction. This is not a local question; it is a national question. The State of Nevada invested Mr. Sutro with authority and arguments with which to present it to the country as a national question, and to assure the country that, in applying its funds to promote the completion of this great work, it was promoting the interests of the whole country."

I want to ask you, General Wright, whether you heard of any of these laboring miners over there being interested in the tunnel; whether they would like to become interested in it; and whether they would like to see the work go through?

A. Some of them, certainly, who were working in the tunnel, as I understand it, were paid partly in stock.

Q. I want to ask you, General, whether these laboring men, in investing in the tunnel, look upon it as a good investment?

A. That I cannot answer.

Q. Did you find any of those men who had invested in the tunnel company?

A. I did; and I found a good many men who had invested in the mines also.

Q. Well, they were speculating in the mines?

A. Undoubtedly.

Mr. SUNDERLAND. But not in the tunnel, I suppose.

A. I don't know. I cannot answer that question.

Mr. SUTRO. Did you hear about that fire in the Gold Hill mines?

A. I did?

Q. Do you think there would have been a greater chance for escape if the tunnel had been in?

Mr. SUNDERLAND. With a bore-hole from the tunnel up to the line?

Mr. WRIGHT. If a connection were made with the tunnel, I should think so—yes.

Mr. SUTRO. Would you, then, consider that these miners are not right in urging the construction of this tunnel?

A. Oh, I think it would add to their security; but I think the same security can be attained in another way.

Q. Wouldn't it give them two chances of escape, either one way or the other?

A. I think it would.

Q. Now, General, I want to ask you about hoisting waste rock in some of the mines. Is it not much more expensive to hoist 4 or 5 tons in a mine than it would be to hoist 200 tons?

A. Undoubtedly, in proportion.

Q. You didn't bring into your account of the cost of hoisting ore the cost of hoisting waste rock?

A. I did not, on account of the indefiniteness of the amount.

Q. Would you think it would cost a great deal more to hoist waste rock, which would actually be limited in quantity, than it would to hoist ore; supposing you take the Ophir mine, where they hoist 12 tons a day?

A. It would cost more per ton than it will to raise 250 tons of ore in a day; certainly more per ton.

Q. Would you think it a fair estimate, excluding the waste rock?

A. I couldn't answer that question.

Q. Mr. King states on page 153 of his report:

"The Hale and Norcross mine, in its report for the year ending March, 1867, furnishes the following statement of costs of mining 29,401 tons of ore:

Managerial cost.....	\$0.31.7
Hoisting power.....	2.38.7
Mining cost.....	4.79.0
Improvement cost.....	65.9
Relative expense, (weighing, sampling, and contingent).....	92.9
	<hr/> 9,08.2"

Could you form any idea at all, General, about what it would cost to hoist waste rock?

A. It would depend entirely upon the quantity furnished per day.

Q. Is it not naturally limited?

A. Certainly it is.

Q. Where they take out 200 or 300 tons of ore, wouldn't the quantity of waste rock only be 5, or 10, or 20, or 30 tons per day?

A. Well, it would depend upon the number of men employed. Where they strike a bonanza, they put in all the men they can work.

Q. Have you ever heard of ore being hidden in a mine by the managers after it had been discovered?

A. I cannot say but I have heard that it has been attempted to keep such a thing secret. I really don't know whether it has been successful. This was a mere rumor. I have no information upon which to substantiate it.

Q. As far as you know, is not the general opinion over there, that these mines are managed for stock-jobbing purposes, in the interest of rings?

A. I think they are managed for stock-jobbing purposes. I don't think they are managed entirely, perhaps, in the interests of a ring. I would like to say, further, that the impression I got there was, that persons did not purchase stock in the mines for purposes of investment at all, but for purposes of speculation, and it mattered very little to them whether the ore was found or only reported to be found.

Q. Hasn't a law been spoken of to be passed for the better protection of stockholders?

A. I don't know.

Q. I will read an extract here from the San Francisco CHRONICLE, of February 16, 1872. It is headed "Mining Management," and is as follows:

"A bill has passed the Assembly, and will soon come up in the Senate, which is intended to correct some of the abuses known to exist in the management of mining corporations. This bill provides that one-half (in interest) of the stockholders of a mining company shall have power to call a general meeting at any time, at which two-thirds of all the stock may remove the trustees and elect new ones in their stead. It also provides that one-third of the stockholders may call for a statement of the affairs of the company—a concession of but little practical value—as any stockholder has now the right to demand an examination of the books whenever he pleases. The bill, as it now stands, is entirely too limited in its scope to meet the exigencies of the case. If one-third of the stockholders could call a meeting, and a majority elect new trustees, it would be more in accordance with practical business ideas. Let us take an illustration from the events of the day. Certain persons have, within the past few days, purchased a majority of the shares of the Savage Mining Company, which is incorporated in this State, and will come under the operation of the proposed law, should it be passed. This transaction involved the purchase of over 8,000 shares of stock, at a price said to exceed \$200 per share. At these figures, \$1,600,000 is the least sum that could have been invested. The purchasers of this interest will be unable to obtain control of the property until July next, when the annual election takes place, and, in the meantime, they are entirely in the power of the present trustees, who are understood to represent an adverse faction; and who, if they choose, may close the mine and levy heavy assessments, or do anything else they please to depreciate the value of the property, to all of which the owners of a majority of the stock are bound to submit, because they have no remedy. It may be said that respectable trustees would not do such things, but 'the experience of the past is the philosophy of the future,' and two years ago, in this very mine, when the same interest as now had control, and their representatives were about to retire from the management, one of their last acts was to make a contract, with mills belonging to their own friends, to crush all ore extracted for the next two years; and it was only under threat of legal proceedings by the in-coming trustees that the contract was rescinded. The circumstances we have related afford a very strong argument in favor of allowing a majority of the stockholders to change the trustees. There are additional safeguards which, in the opinion of many persons interested in this description of property, could be advantageously added to the bill. It might very properly be provided that the eligibility of a person for trustee should depend upon his ownership of a certain proportion of the shares of the company, which should stand in his own name and actually belong to him. Another terrible abuse should also be guarded against by stringent and practical criminal provisions. It should be made a State prison offence for any trustee to be concerned in using the funds of the company for any other than the company's uses; and the same punishment should also apply to the officers who were concerned in conspiracies to depress the value of the stock; by means of fraudulent suits or other well-known devices.

"It would not be difficult to frame a law which would afford the fullest protection to stockholders; and as mining must always be among the leading industries of this State, and as the means for carrying on the business can most conveniently be provided through joint stock organizations, in which the people at large may safely invest, it becomes the duty of the Legislature to make such provisions as shall insure protection from the dishonesty of those to whom the management of other people's property is intrusted."

General, did you hear complaint about the management of mines, so far as the interests of the stockholders are concerned?

A. That I cannot say.

Q. You simply heard that the mines were used for stock-jobbing purposes?

A. Entirely used by the owners of the mines, by outsiders, and the miners themselves; in fact, by all classes of the community.

Q. Did you hear of immense fights taking place, and immense excitement in the election of trustees?

A. I did not.

Q. Did you ever hear of enormous prices being paid for shares, in order to get control of a mine?

A. I did not.

Q. Do those trustees get any salary?

A. I do not know.

Q. It is generally known that they do not. If the tunnel be constructed, would it injure the railroad there?

A. If the tunnel were constructed and used, I think, as we stated in our report, that it would be the financial ruin of the road.

Q. It would be a conflicting interest, then?

A. Yes, sir.

Q. Is it not a usual result of conflict of interests in making improvements, and introducing new systems, that opposition is created?

A. I suppose so.

Q. If a railroad is started, do not all the stage-coach drivers in the country oppose it, whom it would throw out of employment?

A. I presume so. I presume the companies running the excellent wagon roads out there opposed the construction of the railroad. It has worked their financial ruin. They are now comparatively worthless.

Q. In the opposition against the first railroads all sorts of arguments were used, some of them of the most unreasonable character?

A. Shown to be so.

Q. They didn't appear to be unreasonable at the time?

A. I suppose they didn't appear so.

Q. Didn't they state that the species of horses would become extinct, and that oats and barley would become unsaleable articles?

A. I don't remember. There were a great many representations of that general character.

Mr. SUNDERLAND. General Wright, you were asked why the miners on the Comstock were in favor of the Sutro tunnel?

A. I was.

Q. What was your answer?

A. I think it was, I didn't know.

Q. Don't you know that there is a great deal of the stock of the company distributed amongst particular miners?

A. I do not know it. I know that certain of it have been taken by the miners.

Mr. SUTRO. Haven't they paid for all they got?

A. I don't know.

Q. Have you ever heard of a man receiving a share he didn't pay for?

A. I know nothing about it at all, either one way or another.

Mr. SUNDERLAND. Do you indorse that extract from the speech of William Kelley that has been read by Mr. Sutro?

A. I don't indorse any man's speech. I couldn't make any answer to it as a general question. If anything were desired upon the general points, I could give it; but I couldn't express an opinion in reference to the whole of it.

Q. He spoke very feelingly of the unfortunate death of number of miners by the fire. I will get you to state whether the safety, so far as it can be, has not been provided for the miners by the superintendents of the mines?

A. I have no doubt that greater safety could be provided. I think there is reasonable safety provided now in those mines where they are connected. The mines that are work-

ing up their own shaft, and have no connection with any other, I think ought to be forced to make a connection as soon as possible.

Q. If the connection is made from the tunnel upward by bore-holes, would that afford any exit for a miner in case of fire?

A. A simple bore-hole of course would not, but I understood Mr. Sutro to use this bore-hole as a preliminary.

Q. The bore-hole is for the purpose of ventilation.

A. I think not. I did not so understand the question, and my answer had reference simply to drainage. A single bore-hole, say of 4 inches, would carry off a very large amount of water when running under head, but it would afford very little in the way of ventilation.

Q. Do you know how many shafts were connected where the fire took place in Gold Hill?

A. I do not.

Q. Didn't you understand that the counter shaft of the Yellow Jacket, the Kentuck, and the Crown Point were connected?

A. I understood that they are connected; but whether they were at that time I do not know.

Q. Didn't you understand that the men who were lost were at work in each one of those mines?

A. I did not.

Q. The larger number were lost in the Crown Point?

A. My impression, from talking with two of the superintendents, was, that it was the Yellow Jacket.

Q. The fire took place in the Yellow Jacket, but the greater number was lost in the Crown Point. If these shafts are abandoned upon the construction of the tunnel, what escape would there be, then, in case of fire?

A. That would depend entirely upon what part of the lode they were working. If it be below the tunnel level, it would not need a connection with the surface; they would escape by means of the tunnel.

Q. Didn't this fire occur above where the men were at

work? The loss of life was below where the men were at work?

A. That I don't know.

Q. Suppose, upon the completion of the tunnel, the shafts should be abandoned and a fire occur on a level above where the men were at work, what escape would they have?

A. They would have the escape by the connection of the portion of the level on which they are working with the tunnel level. They could go down to the tunnel level. There must be a connection between the point at which they are working and the tunnel, if the mines be operated by the tunnel.

Q. I understand you to say that some of these mines there now will be below the tunnel level before this tunnel is completed.

A. Undoubtedly.

Q. Suppose this fire should occur below the tunnel level and above where the men are at work, what escape will there be for the men at all in case the shafts are abandoned?

A. They would have to work by means of shafts still.

Q. To what point?

A. Up to the tunnel level; and their mode of escape to the tunnel level would be the same as their mode of escape from the present mines to the surface. It would be exactly the same thing.

Q. Do you consider that the construction of the tunnel will cause the sinking of a greater number of shafts than now exist upon the Comstock? In other words, do you suppose that in barren ground shafts would be sunk?

A. I don't know anything about it. Shafts would be sunk where there is any prospect of getting a return, I take it.

Q. Are not shafts sunk now where there is a prospect of getting a return?

A. They so think.

Q. Then, do you think that the construction of the tun-

nel would add anything to the safety of the miners in case of fire?

A. I don't see how it would below the tunnel level. If operations were continued above, and the shafts kept open to the surface, and continued down, to connect with the tunnel, it would afford additional chances for escape.

Q. If a fire occurs in a mine, above where the majority of the men are at work, the gas that is generated by the fire goes down, and extinguishes life?

A. It may, or it may go up.

Q. It goes every way, I guess, don't it?

A. No, sir. If there were a draught down one shaft, and through the connection, and up another, and the fire were to take place near the up-draught shaft, the gas would all ascend, or nearly all.

Q. Well, was there a connection between the Crown Point, the Kentuck, and the Yellow Jacket at the time of the fire there?

A. That I do not know.

Q. Were you not so informed? Have you not so stated in your report?

A. No, sir; I think not. I think we stated that the Yellow Jacket and the Crown Point were connected. I don't think we stated it was connected with the Kentuck!

Q. Do you consider that the construction of the tunnel will cause the sinking of a greater number of shafts than now exist upon the Comstock? In other words, do you suppose that in barren ground shafts would be sunk?

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HEARING, FRIDAY, MARCH 15TH.

Maj. Gen. Foster appeared in response to the invitation of the sub-committee, given at Mr. Sunderland's request.

Mr. Negley said that, in his judgment, he, as chairman of the sub-committee, had no right to administer oaths to witnesses. If Gen. Foster appeared as an officer of the Government, to make further statements in regard to the report of the commissioners, the committee would hear them as before, in the nature of an official report, and without being under oath.

Mr. Sutro said, if General Foster was to be examined as one of Mr. Sunderland's witnesses, he should insist on his being sworn.

Mr. Sunderland replied, that he was willing General Foster should be counted as one of the witnesses he was entitled to bring, and that it was immaterial to him whether his testimony was under oath or not.

After consultation, the sub-committee determined to allow General Foster to make any explanatory statement he desired, in regard to his former testimony, or in regard to the report of the commission, without being sworn; Mr. Sutro to have twice the length of time for cross-examination, occupied by Mr. Sunderland in his direct-examination.

General Foster was then examined by Mr. Sunderland as follows:

Q. You have spoken in your report of a proposition to construct a large dam in the Carson river, at or near the Franklin dam, for the purpose of using the whole power of the Carson river, at the mouth of the tunnel. Please state your present conclusion, in reference to that whole project, in your own words, and in the shortest manner possible.

WITNESS. Do you mean the testimony I gave before the committee, or do you refer to the printed report?

Mr. SUNDERLAND. I refer to that portion of the commissioners' report relating to the dam; and also to that portion of your testimony relating to the same?

A. I have looked over the report a second time, and find it is perfectly correct; but at the same time one or two explanations may be necessary. In the course of my examination I think it was mentioned that the available fall consequent upon this dam, which would be 155 feet—there being another 100 feet fall to the point of the river opposite the tunnel—would be altogether about 250 feet. The only view in which such a statement might be misunderstood is, that which supposes the dam, or the reservoir above the dam, to be filled with water, and that the water is to be drawn off from the top of the dam. And it does not take into consideration, also, the fall of the water in flowing from the dam to the mouth of the tunnel. If, however, in the dry season, from evaporation or from filtration, which is very great, and into which subject I have looked closely, the water in the reservoir should be drawn down, in order to make it available as a reservoir, you must provide for taking out the water at the bottom of the dam, instead of the top, which would leave 100 feet fall in carrying it through an open canal to a point opposite the tunnel.

Q. From what point to what point?

A. From the foot of the dam, near the Franklin dam, to the point on the hill side opposite the tunnel.

Q. Then, what would be the fall obtained by building the dam and constructing the canal, as proposed by General Day in his report?

A. The actual available fall, if the water is carried from the foot of the dam to the mouth of the tunnel, or near the mouth of the tunnel, would be about 90 feet. Now, in regard to the reservoir, the dam proposed would make the reservoir cover about 1,400 acres: the evaporation from which would be about 257 cubic feet per second in the summer.

Q. What would the filtration be?

A. I mean the evaporation and filtration together; the evaporation alone for a year would be about 45 vertical inches in that climate. I make that statement as the result of the observations and reports of French engineers, English engineers, and American engineers, which I have consulted.

Q. How will that compare with the volume of water which flowed in the Carson river at the time you were there?

A. I judge of the water which flowed in the Carson at the time I was there, as it passed through Rock Point flume, at an area of about 25 square feet; which, with a velocity of 4 miles per hour, would give 150 cubic feet per second, or a little more than half the amount of evaporation and filtration in this reservoir.

Q. The evaporation would be greatest during the season when the water is the lowest?

A. In the summer; yes, sir.

Q. Now, General, state how much less power would be given, according to this plan proposed by General Day, of building one dam with a flume attached, than is now obtained in the Carson river by a succession of dams and mills?

A. By the succession of dams now you obtain all the water that flows with, I think, 155 feet fall.

Q. In addition to the 100 feet?

A. In addition to the 100 feet.

Q. After having examined this subject, what is your opinion as to the practicability or possibility of getting sufficient water at the mouth of the tunnel to furnish the power necessary to reduce the ore from the Comstock lode, to supply the power for compressing the air, and for the raising machinery that will be required?

A. I think it will require the additional aid, that I referred to in my first examination, of dams up near the source of the streams that feed the Carson, to provide reservoirs higher up, else there would not be sufficient water.

Q. That same increase of power during the dry season can be obtained now in the same manner?

A. Yes, sir.

Q. With the advantage of 150 feet and more additional fall?

A. Yes, sir.

Q. Do you wish to add any other explanation to that, or does that explain your whole view of the matter?

A. I do not know of anything further I desire to add, unless you ask me direct questions.

Q. I understood you to say that if this water power is not sufficient to reduce and concentrate all the ores of Comstock at the mouth of the tunnel, then the tunnel project would be a failure?

A. Then the project would not be recommended by the commission. No, sir; they would consider it a failure. As they stated in their report, they considered that an essential part of the plan.

By Mr. NEGLEY:

Q. In making your calculations of the amount of water evaporated from the surface of the proposed reservoir, you say it would be greater than by the use of the small dams now in existence?

A. Yes, sir.

Q. If the area of these additional dams or series of dams now constructed were equal to that of a larger reservoir, would the evaporation be the same?

A. Certainly.

Q. Consequently you would have to take into account the area of the present dams, in order to find the difference between the evaporation from the single reservoir and that from the series of dams now constructed?

A. The smaller reservoirs constructed by the dams now in use are confined to the channel of the stream, which is very deep and narrow. The water is confined within the river banks, while the reservoir contemplated by this proposed dam would cover a large area, extending over a tract of 1,400 acres. The evaporation would be much greater

in this case. In France they found, after constructing a new canal, that the whole body of water in the canal would be emptied out in a very few days. After a year had elapsed, they found the whole body would be emptied in considerably less time; and after 12 years, that it would be emptied in a few months: showing the great amount of filtration that was taking place. The character of the rocks along the banks of these streams is favorable to filtration, and the soil is favorable to filtration; so that I hardly think it would be possible to construct so large a reservoir without finding the difficulties from filtration and evaporation insurmountable.

By Mr. SUTRO.

Q. What is the depth of that gorge, through which the Carson makes its way—what is the angle of the walls?

A. It is different at different cross-sections. Where it flows through the mountains, the sides are very precipitous.

Q. What is the angle, in your judgment?

A. It would be necessary to measure it to answer your question accurately.

Q. Have you ever seen a mountain as steep as 45 degrees?

A. I have seen plenty of mountains as steep as that.

Q. Do you think there are many mountains alongside of the Carson as steep as 45 degrees?

A. You know there are, of course.

Q. Are there any steeper than 45 degrees?

A. You know there are, of course; I answer yes.

Q. How much steeper?

A. I cannot answer your question without knowing the measurement.

Q. Have you ever looked at Mount Davidson?

A. I have.

Q. Do you not think Mount Davidson is as steep as any of the mountains along the Carson river?

A. I do not know the object of asking me such a question as that.

Q. I want to ascertain the angle of the sides of the gorge through which the Carson runs, and you can only arrive at it by comparison.

A. You know very well that the sides of Mount Davidson are not as steep as some of the mountains bordering on the Carson.

Q. How much steeper are they?

A. I do not know how to answer your question. In some places the sides are vertical.

Q. For how long a distance are they vertical?

A. I cannot answer.

Q. Are they for as much as 100 feet?

A. I do not undertake to say.

Q. Are they as much as 200 feet?

A. I cannot answer such a question; it is very easy to have a survey made.

Q. Now, General, I want to ask you whether—with mountains rising out of the river on each side, if you should dam the river—would the greatest body of water be at the top or bottom?

A. That is a very indefinite question.

Q. Suppose the dam to be 200 feet high, would the larger body of water be above the height of 150 feet or below?

A. Your question is so vague, I cannot understand it.

Q. I mean, which is the larger area, taking the narrow gorge and going 150 feet in height, and then taking the area 50 feet above?

A. That is a mathematical question, for which you must give me some of the dimensions to enable me to work it out.

Q. Say the river at the bottom is 30 feet in width, at a height of 250 feet it is 800 feet in width, at a height of 300 feet it is 1,500 feet in width I want to know whether or not there is any more water from the line of 250 feet up than there is below that line?

A. With the dimensions you have given, the area below the 800 feet line is about 107,500 feet; the area above is 57,500 feet. Therefore the area above is smaller, and the

body of water would be greater, because the cross-sections, multiplied by the length, would give you the solidity; the area below would be nearly twice the area above.

Q. Is there any difficulty in making a dam 300 feet high, and in making the outlet 50 feet below the top?

A. I think there would be very great difficulty in making that dam 300 feet high.

Q. Will you explain the difficulty?

A. The difficulty is in the pressure of the body of water, the character of the material, and the height.

Q. Do you mean to say, as an engineer that you cannot construct a dam 300 feet high in a rocky gorge so narrow as the one in question?

A. I did not say I could not construct such a dam; I said there would be great difficulty in doing it. I answer your question, that it is not impossible, but it would be very difficult.

Q. Do you say that it would not be practicable to blast out rocks from the sides of the mountain, and let them down into the gorge, so as to make a dam of sufficient strength?

A. It would, of course, be possible to make a dam of sufficient strength.

Q. The difference in the construction of such a dam and a smaller one is simply a question of additional cost, is it not?

A. It is a question of cost and of time.

Q. Do you see any difficulty in blasting down material sufficient to fill up that river 200 or 300 feet in length?

A. You would have to fill it up a greater distance than 200 or 300 feet, if you propose to make the dam 300 feet high.

Q. Say 500 feet, then; would that, in your judgment, be a proper thickness at the bottom? I should like to obtain your opinion on that subject, for we will make that dam some day.

A. The width should be 515 feet.

Q. Now, General, let me ask you whether you see any difficulty in making a gate 50 feet below the top of the dam, so as to allow the water to escape at that point?

A. There is difficulty, of course; it would be practicable and possible.

Q. It would be a simple operation, in fact?

A. No, not a simple operation, but perfectly practicable;

Q. Supposing that to be done, would that make 255 feet fall at the mouth of the tunnel, the outlet being made 50 feet below the top of the dam?

A. No.

Q. How much less will be secured?

A. You will get a fall of 48 feet at the mouth of the tunnel.

Q. How do you figure that out—will you explain it?—supposing the dam to be 200 feet high, which I intended to give as the height, instead of 300 feet?

A. You can suppose anything, but I would not like to base a calculation upon so wild a supposition as that.

Q. Do you consider it wild to make a dam 200 feet high?

A. I do not believe it would be possible to construct a dam 200 feet high, which would stand and hold the water in that gorge. It would be, of course, practicable to build the dam, but I do not believe it would be possible to hold the water with a dam of above 150 feet high.

Q. What would prevent you from retaining the water, supposing the dam to be lined with planks?

A. The water would go through the banks like a sieve, you would have to line the banks almost the entire length of the reservoir.

Q. Do you not know that there is a sort of alkaline earth there, which forms a lining which is impervious to water?

A. No; I know that rock is full of seams, and that you could not prevent the water from filtering through with a dam of the height you propose. In the Louisville and Portland canal, with the same general character of rocks, the water not only filters through the rocks, but burst out

miter sills, with a head of only nine feet; and you proposed a head of 200 feet.

Q. You have just said that it is practicable to construct a dam 200 feet high of sufficient strength; the question, then, is one of leakage?

A. Yes, it is one of leakage.

Q. Could not the dam be lined with two or three thicknesses of planks, so as to make it perfectly water-tight?

A. Yes, you can make a dam water-tight; but I do not intend to say that you can make a junction between the dam and the rocks water-tight. I do not believe you will find it possible to make the junction water-tight with a dam 200 feet high, as you propose.

Q. Suppose you puddle it with clay at the junction, and plank the sides?

A. That would not make any difference; you cannot puddle with clay down into the rock, and it would still leave the junction with the rock not water-tight; and I do not see how it could be made water-tight.

Q. That is contrary to my experience. I have seen them built as tight as a tub?

A. I have seen, within a few months, the miter sills of a ship canal forced out with a head of 9 feet of water.

Q. Now, to return to my question: suppose the dam to be 200 feet high, could you make the outlet 50 feet below the top—can that be done?

A. I do not like to answer any such questions, I consider the supposition altogether too wild, and I do not care to make figures upon it. When you will give me a basis that is practicable, I am ready to make figures upon it.

Q. What is wild in my supposition?

A. The height.

Q. You do not mean to say that you could not build a dam 200 feet high?

A. I do not mean to say that you cannot pile rock 200 feet high. I do say it would be very difficult, if not impossible, to make such a dam that would hold water.

Q. Could you say that, when the dam is to be con-

structed in a rocky gorge, with the sides at an angle of 45 degrees?

A. Yes.

Q. Now, then, suppose the dam to be 200 feet high, and the outlet 50 feet below the top, how much fall could you get at the tunnel?

A. About 100 feet to the mouth of the tunnel.

Q. Would not the fall be 200 feet at the mouth of the flume?

A. It would make about 190 feet fall to the river.

Q. How do you make that out; is there not from the mouth of the tunnel to the river 154 feet, and 100 feet above, making 254 feet in all?

A. If you draw the water off at that height, and let it run at that declivity, you would get about 240 feet fall; but you do not suppose you could keep the reservoir full at that height.

Q. I will come to that in a moment. How much fall is necessary in 5 miles to carry the water from the dam to the mouth of the tunnel?

A. About twelve inches to the mile.

Q. Is that necessary?

A. I do not say it is absolutely necessary; it is a proper allowance.

Q. Have you ever seen flumes absolutely level, and the water still running from them?

A. Water will seek its level of course.

Q. At what rate would water flow in a flume 10 feet deep, if carried at a perfect level?

A. It would not flow at all.

Q. I mean, of course, with an outlet at the end of the flume?

A. With one end full at the dam, and the other end open ten feet deep, the water would flow, of course. The rate of flow would depend altogether upon the head of the reservoir.

Q. Say it has no head at all, but is kept full at one end at the dam and is 10 feet deep and 50 feet in width?

A. The formulas will give you the velocity with which it will flow out. I think it would be about 18 feet a second in the middle of a section 10 feet square in the dam.

Q. How much would that be an hour?

A. About 12 miles an hour.

Q. That is a pretty rapid flow, is it not?

A. That depends upon what you consider rapid; some people would consider it very slow.

Q. Then, with the flume at a perfect level, you would get 254 feet fall?

A. No; my calculation was 240 feet.

Q. You understand that I am now speaking of having the flume perfectly level?

A. I do not undertake to say with this level flume the water delivered would flow at that velocity. You could not deliver a full flume of water without a head of at least 5 feet. Without that, of course the flume would not be full.

Q. Do you mean that it would not carry the water through at all?

A. It would carry it through, but not at this velocity.

Q. Then at what velocity?

A. I am not prepared to state that; I have not a formula here to calculate the friction.

Q. Now, your difficulty is about evaporation. How much do you say it would amount to?

A. In England the average of this year's rain fall is $33\frac{83}{100}$ inches; evaporation, $36\frac{44}{100}$ inches.

Q. I am not now speaking of England, but of Nevada?

A. I am giving you the basis of my calculations. During the winter months the rain fall was $14\frac{19}{100}$ inches; the evaporation, $12\frac{89}{100}$ inches; in the summer the rain fall was $19\frac{36}{100}$ inches, and evaporation $36\frac{51}{100}$ inches. To sum up these observations in England: in localities similar to those of the Carson, Nevada—that is, in dry localities—the evaporation during the year was $44\frac{44}{100}$ inches. At Deep creek, in the Alleghany Mountains, at the summit of the Chesapeake and Ohio canal, the evaporation for 104 days was

14 $\frac{44}{100}$ inches. At Salem, Massachusetts, the evaporation for the year was 56 inches. I think it would be safe to say that the evaporation in Nevada would be at least equal to that of Deep creek, which was 44 $\frac{44}{100}$ inches.

Q. Suppose the evaporation to be 44 $\frac{44}{100}$ inches, and suppose we have a dam 200 feet high, how much would that leave us at the end of the season?

A. That would depend of course upon how much water you would draw off.

Q. Suppose there should be no water drawn off, but it should remain a lake 200 feet deep, and the evaporation should be 44 inches, how deep would it leave that lake?

A. Just 44 inches less. I suppose a little over 196 feet altogether; that is, supposing there was no filtration or leakage.

Q. You say that is a fair statement of the evaporation?

A. Yes. I can give you the French reports, too, if you want them, which give a little more.

Q. We admit that there will be that much evaporation. Now, I want to ask you whether you know anything about the rain fall during the winter or rainy season?

A. Yes. I know from the report of General Day which is here.

Q. Now, suppose there were dams made up in the mountains, would not the evaporation be a great deal more at a higher elevation?

A. Evaporation depends more upon temperature than altitude.

Q. Does it not depend upon elevation to a very large extent?

A. No; the evaporation is greater at the sea shore than in the mountains. It is greater, for instance, at Salem than at Deep creek, in the Alleghany mountains.

Q. Do you know anything about the temperature of the Sierra Nevada mountains in the summer time?

A. I do not know that I do.

Q. Do you not know that in the gorges, where these

dams would be constructed, the heat is greater, than it is on the plains?

A. I suppose you ought to know that.

Q. Did I understand you to say that evaporation is more rapid in higher altitudes than in lower?

A. No; what you are thinking of, I presume, is the point at which water will boil, which is at a much less degree of temperature in the mountains. Evaporation depends upon pressure to some extent, but upon temperature more than anything else.

Q. You stated that you obtain the same fall by the smaller dams which they have now. Now, if you do not get the full amount of fall, do you not make it up in the quantity of water?

A. In case the large dam is built, as the reservoir is drawn off, you must take the water from the bottom of the dam, and you lose all the fall above.

Q. Can you economize all this water unless you make dams somewhere?

A. I presume it will be necessary to economize the water by constructing dams somewhere; but the better way would be, as I said in my first examination, to make them up in the ravines, beyond the dams already in existence. You will then save all the water power, and save also the water, by constructing the reservoir back in the mountains.

Q. I want to ask you one more question, now, in regard to this matter of infiltration, which you have laid great stress upon: whether you have never seen along those plains pools of water formed by the winter rains which have remained all summer, the bottom being water-tight?

A. My observation of the soil of that country is, that it sucks up water with the greatest avidity. You know that the sink of the Carson is not very far from this point, (proposed location of dam,) where the whole river disappears, and that the Humboldt disappears in the same way. I observed that it was a thirsty soil, and that it drinks up water with the greatest avidity.

Q. Do you mean to say that the sink of the Carson, the sink of the Humboldt, and the sink of the Truckee, are to be accounted for by the doctrine of infiltration?

A. I have not made a statement of that kind. I said that the sink of the Humboldt and the sink of the Carson in that vicinity showed that to be a thirsty soil.

Q. Do you say that these rivers sank by filtering into the earth?

A. They filter into the earth or evaporate into the air.

By Mr. SUNDERLAND:

Q. If the water is taken from the top, or near the top of the dam, is there any advantage in the dam as a reservoir?

A. No, none whatever.

Q. If the water should be taken out near the top of the dam, would not the evaporation and percolation be so great, that with the flow of the Carson river in the dry season there would be no water for use at all?

A. The evaporation and filtration in a reservoir of that size would be nearly twice the whole body of water which flows in the Carson in the dry season, according to the observations which I have given you, and which, I think, establish the fact.

HEARING MONDAY, MARCH 18TH.

I. L. REQUA called and examined.

By Mr. SUNDERLAND:

Q. How long have you been upon the coast of California?

A. About 22 years upon the coast.

Q. How long have you been engaged in mining?

A. About 17 years in mining and milling.

Q. What portion of that time have you been engaged in milling actually?

A. About six years.

Q. How long have you been upon the Comstock?

A. Eleven years next June.

Q. What has been your business since you have been upon the Comstock?

A. Mining and milling.

Q. In what capacity?

A. In mining and milling—in running a mill. I have always owned an interest in it—running it for myself and parties owning it with me.

Q. Then you superintended it?

A. Yes, sir.

Q. When not engaged in milling, what were you engaged in?

A. Mining and superintending.

Q. Are you acquainted with the mills on Carson river?

A. I am, sir.

Q. I will get you to give the names of those mills, together with their capacity—the capacity of each, and their value?

A. I will start first with the Mexican, 150 tons capacity, value \$250,000; the Morgan, 100 tons capacity, value \$150,000; Brunswick, 200 tons, value \$300,000; the Merimack, 45 tons, value \$100,000; the Vivian, 35 tons, value \$75,000; the Santiago, 70 tons, \$140,000; Eureka, just

completed, 200 tons, cost \$350,000; Franklin, 30 tons, \$75,000; Woodworth, 80 tons, \$150,000; Birdsall, 120 tons, valued at \$240,000; Rock Point, 80 tons, value \$100,000: making a total of 1,110 tons per day, and a total valuation of \$1,980,000.

By the CHAIRMAN:

Q. May I ask what the valuation is taken from?

A. It is taken from the owners of the mills, the prices paid for them, and the amount of their cost—the value set upon them by the men who own them.

By Mr. SUNDERLAND:

Q. I will get you to state now whether these mills occupy all, or, if not all, what proportion of the available mill-sites and power upon that river?

A. I think nearly all. I believe they calculate that there are about two sites more that could be made available.

Q. Do you remember the fall in each or either of those mill-sites not now occupied?

A. I think they estimate one at about 20 feet, which could be increased some; the other about fifteen.

Q. How does the capacity of the mills upon the Carson river compare, in its reduction of ore, with the Comstock?

A. The mills on the Carson river will work all the ore that the Comstock is producing to-day within 300 tons.

Q. Compared with the value or cost of the mills, what would be the expense of removing the mills from their present location to a point on the Carson river opposite the mouth of the Sutro tunnel?

A. Let me see if I understand you correctly. Your question is, what will be the expense of removing the mills.

Q. Taking into consideration the damage and injury done to any or every part of the mill in tearing it down and removing it.

A. I might almost as well build them up anew. As a rule, they are so built. Old quartz mills are not valued very highly, except for the old iron contained in them;

that is, as far as removing them and putting them up anew. The rule is to use new material. Those who do not do so, generally regret it.

Q. How many mills have you known to be removed from one point to another in that district?

A. Well, I do not recollect now of any that were removed from one point to another in that district. I know of one or two that were taken down and refitted and taken to White Pine. I have no recollection of any, at present, being removed in that district. General Williams moved one from American Flat down to Spring Valley, I believe. I heard the General myself say that it cost more than it would to build a new mill, and he has no mill now.

Q. According to the survey and report of General Day, what would be the fall from the proposed dam of the Carson river, at or near the Franklin dam, to a point opposite the Sutro tunnel, if the dam is used for a reservoir?

A. General Day gives that here in his report. He says the point selected is the Franklin dam.

Q. The fall of the river from this point to the point opposite the Sutro tunnel is 100 feet?

A. I never surveyed it.

Q. How high is the bank there?

WITNESS. The bank where?

MR. SUNDERLAND. At a point opposite the Sutro tunnel.

A. My recollection is the banks are not high.

Q. Ten feet?

A. Might be 15 or 20. It runs off very flat. I never measured them.

Q. Then, what would the whole be, supposing it is 10 or 15 feet?

A. General Day says here that the fall of the river is 100 feet. I think that answers the question.

Q. The height of the bank then would be deducted from the 100 feet, would it not?

H. That I could not say. I did not make the survey. I should infer it would—the river bank or river bed, whichever he measured. If you measure the bed, you get a fall

of 100; if you measure at the surface, I presume his calculation was the same. I do not think there is very much difference.

Q. What would be the proportion of power at a point opposite the tunnel, where this water could be taken from the reservoir, as proposed, to the power now utilized in the Carson river?

A. There would be 55 feet less than the present fall, according to General Day. I think that is it.

Q. How much of a fall is there below Rock Point to the point below the fall?

A. That I could not say. There is 155 feet to the Franklin dam, and 100 feet from there down.

Q. That is 255 feet?

A. Yes, sir.

WITNESS. Do you include the Rock Point mill in that question?

COUNSEL. That is the one I am talking about now—about the mills on the Carson river, as they exist at present.

WITNESS. (resuming.) One hundred and fifty-five feet from the Mexican dam to the Franklin dam and fall of the river. From the Franklin dam to a point opposite the tunnel is 100 feet.

Q. Below the Rock Point mill, is there any such fall in the river as could be utilized for power? Is there sufficient fall to run any mill of any description?

A. Well, there might be a possibility of getting in one mill with a very small fall.

Q. About how much?

A. That is an opinion that is called for, because I never surveyed that. I had no figures for it.

Q. Does the current flow rapidly below where the race comes into the river from Rock Point mill?

A. No, sir; goes very sluggishly.

Q. Now, you have given the present capacity of the mills on the Carson river at about 1,100 tons per day. Taking this present fall utilized—the power utilized upon the river now—and comparing it with the 90 feet, or what

ever the fall is of the Franklin dam, down to a point opposite the tunnel, how will the power at the mouth of the tunnel compare with the present power as utilized on the Carson river?

A. Be about one-third less.

Q. Do you know anything about the quantity of water required for concentrating?

A. No, only what I have seen operated there in Virginia City.

Q. What kind of concentration do you refer to?

Mr. SUNDERLAND. That is a little more than I can tell you, because I am not sufficiently acquainted with the machinery for concentration.

Q. What kind of concentration have you seen used there?

A. There was an effort made there at one time by Mr. Uzney to concentrate the ore in a coarser state, not in pulp—broken up in small pieces from the size of a pea to a walnut. That was a failure, because there was not water enough in the whole of that section of country to concentrate ten tons a day with. Aside from that, the concentration was a failure, because it did not work as he anticipated.

Q. Do you know what he called that—the machinery he used?

A. No, sir; I talked with him about it, and he said it was still used in Germany.

Q. Deducting any quantity of water that might be necessary for concentrating and compressing air at the mouth of the tunnel in the Comstock, what amount of power would be left for milling at the point opposite the mouth of the tunnel?

A. That would all depend upon the amount of air that you compressed. You could not arrive at that at all without definitely stating the amount of air that would be necessary.

Q. Well, it would require power to compress air, and

also to concentrate, over and above the water used for the reduction of the ore to a pulp, would it not?

A. I suppose so.

Q. Then, I will get you to state whether or not there would be power, taking the water as proposed in this reservoir, and taking it to a point opposite the tunnel, to reduce the ore of the Comstock, if the mines would yield as they do now.

A. No, sir; there would not.

Q. Do you know anything about the cost of milling upon the Carson river at present, and after the ore is delivered at the mill?

A. They claim to do it there for \$4 50 per ton.

Q. You are a mill man; you have been engaged in that business how long?

A. Some six years?

Q. I will get you to state whether that is an unreasonable estimate upon the cost of milling?

A. Not in the manner they are milling—I should say not. I should think that is a very fair estimate.

Q. What prices were paid for milling ore when you first went upon the Comstock?

A. I milled ore that I got \$25 per ton for milling.

Q. What are the prices now paid?

A. Twelve dollars is the highest.

Q. What is the lowest?

A. They mill it as low down as \$8.

Q. Does the difference depend upon the quality of the ore?

A. Well, nothing material in quality. If it was very rich, they could not mill so much of it. It would be worth a little more money to mill it—the class of ore they are milling there now. The best of them are milling at \$12.

Q. If this dam, as proposed, should be erected 155 feet, what milling property or mill property on the river would be destroyed?

A. It would destroy—

Q. State whether it would not destroy all of it, as a matter of fact?

A. As a matter of fact, if the dam were erected, it would destroy the whole of it.

Q. What injury would the erection of that dam be to the railroad?

WITNESS. Do you mean if the ores were taken out of the mouth of the tunnel?

Q. I first want to ask you if it would not overflow a number of mills on the railroad?

A. Yes, sir; it would.

Q. Would it be possible to raise that road so as to take it above the overflow, considering the steepness of the hills there, and would it not be an absolute destruction of a number of the mills on the railroad?

A. It would be possible to raise it up, but it would be quite impracticable.

Q. Taking into consideration the expense the tunnel was constructed at, and the ores transported through the tunnel, would the business upon the railroad pay for operating it?

A. That is a rule of supposition I do not like to work by.

Q. What business has the railroad now?

A. The railroad has all the business connected with the transportation of ores and the mill wood to Virginia City, and a great deal of other business—timber, lumber, coal: about all the transportation that is done in connection with mines and mills, and a great deal of outside freight, and soon will carry everything that comes from Reno, on the line of the Central Pacific.

Q. That is the general freight you refer to?

A. Yes, sir.

Q. Suppose, now, that the business of ore hauling to Virginia City should be removed to the mouth of the tunnel, what business would there be for that railroad to transact?

A. None.

Q. About how much has that road cost?

A. Well, the probable cost of it was about \$1,800,000; that is, the Carson branch. I do not know what the other section will cost.

Q. What is the distance from Virginia City to Carson, the road that you speak of that cost about \$1,800,000?

A. About 23 miles distant between the two points, but running up around the mountains.

Q. I am speaking about the length of the road?

A. About 23 miles.

Q. What is the distance of the road from Reno to Carson City—to complete the road from Reno to Virginia City?

A. About 30 miles, I believe, or 30.

Q. Is there any other property that would be destroyed by this immense reservoir?

A. Well, my opinion is, that if the reservoir were built, and could be made tight to hold that amount of water, it must destroy Carson City as a place of residence. Fever and ague would drive the people away. People cannot live upon the river now in the summer season.

Q. What is the general health on the Carson river?

A. Not very good. They have the fever and ague down there very badly.

Q. Do you know of any families that have been obliged to leave there at a particular season of the year, and if so, when and who?

A. Some of the superintendents take their families away in the summer season, in consequence of its being so unhealthy.

Q. Do you know anything about the suspension of work at Franklin mill, because of sickness, last fall?

A. I do not know of work being suspended, but they kept changing men constantly. One gang got sick and they would have to go off, and then they would get another, and so it would be. It was the same way with Eureka. They employed a large number of hands there in the completion of the mill, but they were bothered a great deal by the men getting sick.

Q. Do you know anything about the effect of irrigation on the health of the people and on the ground irrigated?

A. No sir; I do not know anything about it.

Q. Do you know anything about the healthfulness of the climate in the neighborhood of the *sink* of the Carson or *Humboldt*?

A. No, sir.

Q. Of the present mode of working ores, about what is the percentage saved?

A. Of the present mode of working ores, that is, before the slime and tailings are entirely passed off, the estimate is 90 per cent.—92, I think. I would like to explain that a little, for those gentlemen who do not understand it. First, the ore is taken to the mill. It is crushed in the form of pulp, and put in a pan and worked. The product of that is the *greatest*. Then it is passed from the mill in a series of reservoirs, falling one below the other, until from the last reservoir the water as a rule runs off nearly clear—clear enough to drink with us.

Q. Could you illustrate it any better if you had Mr. King's drawings?

A. No, sir; I think I can explain it so the gentlemen can understand it. The reservoirs are large. They are dug out of the earth. After they fill, the water is turned into another series of reservoirs, and these are cleaned out. The material is wheeled out, taken upon the dry ground, and exposed to the sun. They are allowed to "slack," as they term it. It is dried, carried to the slime mills, and worked under a peculiar process—one new to that section, so far as I have heard or read of. It passes from that into other reservoirs, and is preserved precisely in the same manner as it was in the beginning. Those reservoirs in turn are cleaned out the same as the first, and then are worked over and over again, until the slime mill considers it not valuable enough for them to work it again, and it is left to run down on the Carson river, where there is another very large mill. There it is concentrated in a reservoir, and sold at the rate of fifty cents per ton. Those parties work it.

They work slimes there that assay \$8 a ton, and make money out of it. They work it, and it is then caught again by the parties who sell it to them, stacked up, and held in reserve for a future working. That is as worked to-day. The estimates are, and I think they are very correct, 90 per cent. of all the precious metal that is contained in the ore is extracted. In making up the annual reports of these various mines, they state how much is taken from the ore; that is, the first working; and as a rule it will go as high as 72 the first working.

Q. What report is that you have?

A. This is my report of last year.

Q. What return did you get?

A. I do not find it there. I will try and get it. I do not think it is in this report.

Q. That is the system of working to-day on the Comstock lode?

A. Yes, sir.

Q. I understand Professor Newcomb, in his examination, to say that there was great loss of these slimes and tailings generally, and that there was danger of their all flowing down the cañons, as they were piled up in the reservoirs. I will ask you now, if the winter just past has not been as severe, if not more so, as any you have seen since you have been here?

A. No, sir; it has been as severe as any within the last ten years, but the winter ten years ago was much more severe.

Q. Were any of the tailings or slimes lost by the freshets during last winter?

A. Not that I know of.

Q. Is there any possibility of a loss, the way that people are prepared from one end of the cañons to the other upon the Carson river, in cases of floods?

A. There is no probability—scarcely a possibility. They have provided for those things in the lessons taught them by the experience of the past.

Q. Then, if any one reservoir should break away, the

tailings and slimes would be caught at some place below them on the Carson river?

A. There is no doubt of that, I think.

Q. I understand you to say that the slimes were dried before working?

A. Yes, sir.

Q. Now, I will get you to state if they have been worked successfully in any other way in that country?

A. They never have.

Q. Do you know anything about any experiments that have been made to work them without drying them?

A. Yes, sir; I have made some myself and I know of others who have made them, and they proved failures in every case.

Q. I forgot, in reference to that dam, to ask you, if the water was taken out at the top of the dam, so as to give the fall in the river we now have, whether, from percolation and loss of water by all other means—evaporation, &c.—there would be any, and, if any, how much, water to flow in the ditch or flume from the dam to a point opposite the tunnel?

A. I think General Foster's answer to that was a very correct one—his figures. That is an estimate I have not made, but my experience teaches me that a dam of that height, overflowing that amount of ground in that section of country, would be almost useless.

Q. You made a report, I believe, to the Sutro tunnel commissioners, did you not?

A. I did.

Q. I will get you to state now whether all the facts set forth in that report are true?

A. They are, or my name would never have been signed to them.

Q. Both with regard to the hoisting of ore and pumping?

A. I say nothing about pumping.

Q. You did not have any pumping?

A. No, sir.

Q. I will get you to state whether, since you have been upon the Comstock, there has been any, and, if so, what, reduction in the cost of mining?

A. There has been no reduction in labor. The reduction has been in timber and transportation of freight from California and the better mode of mining—more systematic.

Q. I believe your president, in his last report, states that the cost of mining and milling, for the year ending 1871, was about \$1 50 less than it was for the previous year. Is that correct?

A. I think that is correct.

Q. I will ask you if, notwithstanding the mines are being worked deeper every year, the cost of mining has not decreased from the very commencement until the present time?

A. No doubt of that.

Q. What effect has the building of the Virginia and Truckee railroad had upon the cost of supplies and the transportation of ore from the mines to the mills?

A. It has reduced the cost of supplies at least one-third. In the transportation of ores, the reduction has not been so great. Had not the railroad been completed, it would have been very much more. They were combining to put the price up.

Q. During the time that the railroad has reduced the cost of supplies, has not the timber and wood every year become more inaccessible in the mountains?

A. Yes, sir.

Q. Then, do you attribute the reduced price of supplies solely to the building of the railroad?

A. I see no other source to attribute it to.

Q. Could the tunnel, if completed, be of any advantage to your mine, in any way at all—in the way of ventilation, drainage, or transportation of ore?

A. In my report to the commissioner I say it could not. My opinion has not changed upon that subject.

By the CHAIRMAN:

Q. I believe you have not stated what mine this is?

A. The Chollar Potosi.

Q. Then, if completed, it would be an absolute tax of \$2 per ton upon all ores taken out, without any compensation whatever?

A. With the understanding of the royalty attached to it.

By Mr. SUNDERLAND:

Q. Is there or not a large amount of low-grade ore in the Chollar-Potosi mine?

A. There are hundreds of thousands of tons, as I have stated before, of low grades of ore.

Q. What proportion of that could, by possibility, be worked with profit without paying this royalty of \$2 per ton?

A. It is difficult to answer that. It will be altogether owing to how long before the royalty would attach. If it is a matter of three or four years, the mine will be pretty well exhausted; that is, so far as we have any knowledge of ores existing.

Q. What, in your opinion, would be the effect upon the working of the low-grade ores, or, in fact, the whole of the Comstock, if the tunnel were completed, and the mine had to pay this royalty?

A. That is very similar. If the royalty attaches in three or four years, the present indications are that the ore would be pretty thoroughly exhausted. The remaining ore would be so low in value, that it could not afford to pay the \$2 royalty.

Q. Would a great portion of the work upon the Comstock cease?

A. That would be the effect, I think.

Q. You are pretty well acquainted with the depths of the shafts upon the Comstock, are you not?

A. Yes, sir.

Q. How long will it be before a majority of them are down to the tunnel level?

A. Not to exceed six months at the rate they are sinking.

Q. Do you know the depth of the Yellow Jacket?

A. I have received a dispatch from the superintendent to-day, stating that they were down to the level of the Sutro tunnel.

Q. Who is the superintendent of that mine?

A. G. T. Taylor.

Q. You rely upon the facts stated in that telegram?

A. Most undoubtedly. If there is a man of veracity living, he is one.

Q. After the shafts have reached the level of the tunnel, of what advantage possibly could the tunnel be to the mines, either for ventilation, drainage, or otherwise?

A. I can see no advantage to accrue to the mine on the completion of the tunnel.

Q. You know something about the litigation that we have had out there?

A. Yes, sir.

Q. I will ask you whether the most of it has not arisen from disputes as to whether there was one or more ledges?

A. That has been the cause of most of the litigation on the lode.

Q. Suppose the tunnel were to run in, and find a bed of ore not yet found by any mine?

A. That is the rule of supposition, upon which I do not like to work.

Q. I will ask you whether every body of ore discovered upon the Comstock in going down has not been found farther east than any body above it?

A. Yes, sir; that is a fact. That is owing to the conformation of the western country, which carries it to the eastward.

Q. Then there is a liability, is there not, for the same disputes to arise that formerly arose in finding one body of ore farther east than another, and the parties finding the body of ore to the east claiming that there were two ledges?

A. Possibility, but not much probability; because the Comstock points are too well defined to admit of that kind of litigation to-day.

Q. Did you ever know a Mr. Carlile?

A. I never had much of an acquaintance with Mr. Carlile; I know him by sight.

Q. He has been mentioned here as a very eminent engineer.

A. He is a good figurer, but rather impracticable. He has been found such.

Q. In what capacity was he employed upon the Comstock, and by whom?

A. He was at one time in the employ of the Gould and Curry company, when Mr. Strong was superintendent.

Q. Do you know anything about his putting up an engine on the ground?

A. He is credited with having put one up on the ground in the Gould and Curry.

Q. Do you know anything about his drawing a plan for a wheel that was to be put under the ground, attached to this engine?

A. Yes, sir.

Q. What was the wheel—a fly-wheel or a cog-wheel?

A. A friction-wheel, I think.

Q. What was the size of the shaft down which the wheel was to be lowered?

A. The apartments were about $4\frac{1}{2}$ feet by 5.

Q. What was the size of the wheel?

A. My recollection is 15 or 16 feet in diameter.

Q. Did he get the wheel down?

A. No, sir; I think not.

Q. Do you know anything about his setting up an engine at the Gould and Curry mill?

A. I know he set up one at the mill.

Q. What kind of a job did he make of it?

A. The engine was entirely too light to do the duty it was called on to do.

Q. Did it retain its place?

A. There was a great deal of extra fastening and bolting, and they managed to work it for a season.

Q. Have you ever known, since your connection with the Comstock, any want of capital for the purpose of working the mine or building or running the mill?

A. I never have. They have always obtained all the capital required, as far as I know.

Q. You never had to call for money but what you got it?

A. No, sir.

Q. Do you remember the name of a Frenchman mentioned by Professor Newcomb as having built a mill in Virginia City?

A. No, sir.

Q. Do you recollect the name?

A. I could not speak the name. The Professor gives it, but I have no recollection of a man by that name.

Q. You have known all mills built there?

A. Nearly so.

Q. Do you know whether any such man ever built a mill there?

A. I have no recollection; I never heard of a man of that name building a mill or having anything to do with a mill.

Q. Would not you be likely to know if he ever built a mill there?

A. Yes, it would be very likely I should.

Q. Have not you known all the mill men there?

A. There never were any there that were there for any length of time that I have not known.

Q. Dr. Newcomb says that he requested the superintendents upon the Comstock to make the strongest arguments they could against the tunnel. Was any such request ever made of you by any one of the commission?

A. Neither of the commissioners ever made that remark to me.

Q. What did they ask you to do?

A. They did not ask me to do anything. They presented this circular, as you see it here. You will notice there are a series of questions. That is, so far as the answers to them

are concerned, they simply sent them through the post office, requesting an answer.

Q. Have you thought sufficiently of that dam to give an opinion of its practicability?

A. In what sense?

Q. Whether it would be an economical expenditure of money, as compared with the present mode of utilizing the waters of the Carson river.

A. I can see nothing to be gained by the dam, as the river affords about as much power to-day as could be well obtained from the dam, provided the dam works successfully.

Q. And the successful working of it is not problematical, in my mind.

A. I think it could not be made a success, in consequence of percolation, filtration, and evaporation.

Q. That is just what I was going to ask you about. What is the conformation of the other side of the Carson river?

A. The formation of that whole country is shattered and seamy. There is a pressure upon the dam, if it could be filled, that would be so great, that it would assist very materially in forcing the water out.

Q. Do you know anything about the bed of the river—what it is composed of?

A. I saw where they had built a dam at the Eureka mill last summer; on either side of the river they got bed rock, but in the center they went down to a great depth and did not get it. They went into gravel, and finally put the dam down there and completed it in that way.

Q. Do you remember how deep they went?

A. I did not see the exact depth—they had commenced to fill it up; but they told me 20 feet below the bed of the river they found no bed rock; that is, they told me they did not.

Q. State what percentage was saved and returned to the mine, if you remember it?

A. It was about 72 per cent. for the year ending May 31 last, the company's year.

Cross-examined by Mr. Sutro.

Q. You are superintendent of the Chollar Potosi?

A. Yes, sir.

Q. How long have you been in that position?

A. Five years next July.

Q. You say you have had a large experience in mining?

A. Yes, sir.

Q. That you have been in California?

A. Yes, sir.

Q. Twenty-two years?

A. Yes, sir; on the Pacific coast about that time.

Q. And been mining a great number of years—I forget how many you stated?

A. I have been engaged mainly in the milling and mining business on the coast.

Q. Are you a mining engineer?

A. No, sir; I make no claim of that character.

Q. Have you ever visited any mines of Europe?

A. No, sir; I never was in Europe.

Q. Have you ever read any books on mining?

A. I have read a few, not many.

Q. Have you ever studied geology?

A. No, sir; not as a study.

Q. Have you ever studied mineralogy?

A. Not specially.

Q. Are you acquainted with chemistry?

A. No, sir.

Q. Then your experience of mining is confined—

A. To experience alone.

Q. In California and in Nevada?

A. Yes, sir.

Q. What quartz mines have you been engaged on in California?

A. No quartz; what we call surface: hill-diggings, drift-diggings.

Q. Then your experience in quartz and lode mining is confined to the Comstock lode?

A. Yes, sir.

Q. Did you ever visit any other?

A. I have visited them; yes.

Q. Name them, if you please.

A. The lode in Sierraville. I forget the name; but that of the Sierraville mine. I have been once in Grass Valley, but I did not go there for the purpose of viewing the mines critically; I looked them over, however.

Q. How much time did you spend in Grass Valley.

A. Not to exceed two days.

Q. You just went there for a visit?

A. Yes, sir.

Q. Then, if I understand you aright, your whole experience in lode mining has been on the Comstock lode?

A. That is correct.

Q. You have spoken of the mills on Carson river, and have stated that their cost is one million eight hundred and ninety thousand dollars, (\$1,890,000.) How do you arrive at that figure?

A. I arrive at it by the prices paid. Some of the mills changed hands recently by the cost of the construction of the Eureka mill, which is about completed. The mills on the Carson river are to be valued very much higher than they were a year ago, in consequence of the accumulated amount of ore that is said to exist in Crown Point and Belcher.

Q. Do you know how much they are taxed for?

A. I do not.

Q. Have you any idea that they are taxed at any such figures as that?

A. I have no idea what the taxes are.

Q. Are you interested in any of those mills on the river?

A. No, sir; not one.

Q. You say those mills have a capacity of 1,100 tons?

A. Yes, sir.

Q. Can they work that in the dry season?

A. I could not say they could.

Q. How much did they work?

A. Last summer they hung up entirely in the dry season.

Q. They could scarcely work anything at all, could they?

A. No, sir. I know some of them that were entirely hung up.

Q. Are they not very much troubled by high water in winter time?

A. They have not been very much this last winter.

Q. Some of the dams have been carried away this winter, I believe?

A. Not any. There was a small break in the Mexican dam; which was repaired, however, at a high stage of water. It is running now.

Q. None other?

A. None other, that I recollect of. There was a little damage done to the Brunswick, but that amounted to nothing.

Q. Is that all?

A. That is all I recollect.

Q. I will read from an article in the "TERRITORIAL ENTERPRISE," dated Sunday, March 10, 1872.

WITNESS. That is since I left there.

"RESUMED OPERATIONS.—The Vivian mill, Carson river, started up day before yesterday. The mill has been shut down since the flood in the river last winter. The dam and bulkhead have been repaired, and the mill will now run regularly, and, unless there be another flood this spring, will most probably not again be shut down until it shall become necessary to stop for a general overhauling, on account of the wearing out of the machinery. It is not likely that there will be any stoppages occurring this season on account of low water."

WITNESS. I will state, in connection with that, the damage was merely nominal. They could get no ore at the mill at all, in consequence of the road being carried away, and they made no effort whatever to repair the small amount of damage that occurred there.

Q. It must have been shut up.

A. Shut up because they could not get any ore to work.

Q. Why?

A. Because they had other mills that they could work ore in to equally as good an advantage, of greater capacity.

Q. How did you come to have this statement here of the cost of these different mills? Did you prepare that on purpose?

A. I have prepared that since I came here.

Q. How did you get those figures, here?

A. From my own knowledge.

Q. It is not taken from any official figures?

A. No, sir; not at all. I know all about the Mexican mill and the parties owning it—the cost of fitting it, and the cost of repairs. The Morgan mill the same way, and also the Franklin mill.

Q. Who assisted you in making up these figures?

A. No one; I made them up myself from the knowledge I had obtained during my residence in that country.

Q. Did you not consult Mr. Sunderland?

A. Mr. Sunderland did not have anything to say about it.

Q. Did you not show it to him?

A. It is likely I did.

Q. Did you not consult Mr. Batterman about it?

A. I think not of any moment. I may have talked over it since here; but every figure there, I think, is of my own making.

Q. You have stated that it would be as cheap to build new mills as to remove the old ones.

A. That is my experience in that country.

Q. Does not that remark apply to worn-out mills?

A. Well, the fact is, that with any mill that has been run for any length of time, if you attempt to remove it and to replace the machinery necessary to fit it up, it will cost about as much as to buy new machinery out and out.

Q. Is there any difficulty in moving a steam-engine and putting it up again?

A. Not any special difficulty.

Q. Where is the great difficulty about the pans, stamps, and batteries?

A. The pans, stamps, and batteries would be decayed more or less.

Q. What about the stamps?

A. The iron, by use, usually becomes crystalized, and the pans, by standing, rust rapidly, and it becomes difficult to move them and set them up in a new place; so that, with taking them down and the labor and expense of removal I should think it would be better on the whole to build new mills in preference to undergoing the process of removal. If I built a new mill, when I got it done I would have a good one; one I could depend on to run steadily. If I take an old mill and tear it down and put it up anew, there are a great many parts in it that are liable to give out.

Q. I infer from that remark that these mills wear out pretty rapidly?

A. Yes, sir.

Q. How often do you have to replace the stamps and the pans?

A. The pans in the manner they use them now? I know pans that are working—that have been, through repairs that have been put upon them, working for the last five or six years.

Q. How often do the shoes in those pans wear out, or the bottom and shoes both?

A. That depends upon the iron they are made of.

Q. Suppose you take the best chilled iron?

A. A good mill man never uses that. He takes soft iron, and this is calculated to wear out a set of shoes every three weeks. The dies will wear longer.

Q. I believe that is one of the experiences you have made out there—that of using soft iron?

A. That is an experiment that has proved of value.

Q. Can you explain why?

A. For the reason that two hard substances do not grind as well as soft ones. You may take two pieces of marble and rub them together in this manner, (illustrating his meaning by moving his hands one upon the other;) the friction is so slight, that the wear is very limited. You

take two pieces of soft metal and rub them together in the same way, and the particles underneath—whatever comes in contact with the iron—reduces it much more rapidly than it does between hard surfaces.

Q. Is there any other reason?

A. That is the principal reason. The other reasons may be, that the iron, in reducing in that way, may assist in amalgamation, wearing it more rapidly. But the principal reason, in consequence of the grinding, is, that the soft surfaces reduce the pulp much finer and more rapidly, giving much better results in amalgamation.

Q. You say that the shoes and dies wear out about every three weeks?

A. The shoes. The dies wear longer. The dies being stationary and the shoes being in motion, the parts in motion wear more rapidly than that which is stationary.

Q. How long do the shoes attached to the stamps last?

A. That depends a great deal upon the depth of the casting. Some of them are cast eight or nine inches thick, others only five inches.

Q. Do you speak of the ordinary revolving stamp?

A. Yes, sir; some do not have as great depth to their shoes. I have seen them ten inches deep. I have used them myself of that depth.

Q. From where they fasten on the stamp?

A. Yes, sir; I have seen other works that only cast them five or six inches in height, but of course the wearing out depends upon the depth.

Q. Did you state how long they lasted, taking the average between five and ten inches?

A. I have run shoes and dies as long as sixty days, that is, the shoes without the dies; the dies are much less, as you know. I have run a set of shoes ninety days, but they were of very superior chilled iron.

Q. How deep?

A. I think ten inches.

Q. How long does a die usually last?

A. That depends a great deal upon the depth. Some of

them are deeper than others; but, take the average of them, I suppose they last four weeks, or perhaps five.

Q. How long does a screen last?

A. That is one of those things that is liable to an accident.

Q. But take the kind of screen you use. You use sheet-iron screens, do you not, altogether?

A. No, sir; we use wire screens.

Q. How long does one last, according to your experience?

A. There can be no rule. I have seen a new screen—a wire screen—put in and burst in two hours, and a common wire screen on the same mill would run from two to three weeks. There is no rule to guide it.

Q. Do you not look upon it as something extraordinary if a screen lasts a month?

A. If a punch or wire screen lasts a month it is a long time.

Q. But I presume they do make them last that time. Is it not your experience in keeping up those mills, that the wearing out of these different parts, including the amalgamating machinery, involves one invariable heavy expense?

A. Yes, sir.

Q. Do you use chemicals in amalgamation?

A. Some.

Q. Do they not corrode your pans very rapidly?

A. To a certain extent.

Q. Do you not think a mill pretty generally wears out every two years on an average?

A. No, sir; I would not say two years; that would be rather a short time.

Q. I mean putting aside the consideration of repairs—the expense of keeping it in good condition.

WITNESS. You mean to take a mill, build it new, and that at the end of two years it will be pretty well worn out?

Mr. SUTRO. Yes, sir.

WITNESS. I would differ with you a little there. I have

had them to last longer than two years. As you say, the expense of repairs, &c., is considerable. You are liable to break a new stamp before you have run a month, and then I have known them to run twelve months without breaking.

Q. You cannot run a mill without making repairs?

A. If anything gives out, you must repair it; and a mill kept in that condition and run systematically, with the necessary repairs, would run, I should think, about four years, without any very extended expenditures for repairs.

Q. What is there about a mill besides this amalgamating machinery, pans, and settlers, that is expensive?

A. The pans, settlers, and agitators, rock-breakers, power, belting, and wear and tear.

Q. What else is there that will wear out?

A. All of these, when you enumerated them specially.

Q. Take the machinery and leave out the simple parts which are connected with it, such as belting and all that—take the machinery, take the batteries and pans, and everything connected with them, the settlers—and what else is there about a mill that will wear out, including your rock-breakers?

A. The steam engine also, if you have that?

Q. We are speaking of water mills. What is there that will wear out?

A. You have enumerated about all that constitutes a quartz mill. Most of these will wear out. The principal parts, such as batteries, pans, and settlers, will wear out very rapidly.

Q. What would the buildings amount to?

A. The buildings, as a rule, are not of any great value.

Q. You do not mean to say that it would be a very great loss to move these mills if parties knew that in three years they would have to remove them, if they let them run down, only keeping up such repairs as are absolutely necessary? Would you consider it to be much of a loss?

WITNESS. You mean that really no repairs whatever are

to be made? You mean to let it run until it runs out, and then get a new one?

Q. There would not be much loss resulting therefrom, would there?

(No response.)

Q. Now, in making this estimate of \$1,980,000, you have stated that you lately, since the discovery of those great bodies of ore in the Belcher mine and the Crown Point mine, learned that the value has risen to about that sum?

A. Not to that sum. By no means. They had a specific value before.

Q. They had a specific value, but it is not up to these figures?

A. Yes, sir; the value depreciated in consequence of the very strong probability that there would not be sufficient work for them.

Q. Then in this estimate you have included the value of the water power?

A. Of course. I consider that a part of the mill, if you were going to make an offer for a mill; for instance, the Mexican mill, the Morgan mill, and the Brunswick mill, which were recently purchased by the parties now owning them—they have paid a certain amount for repairs which makes them come up to every dollar for which they are set down. I made that estimate as to the entire value of the mill and water power.

Q. What portion of the \$1,980,000 would you consider the value of either mill-site or water power to be?

A. The power and the mill-site—well, it would be very difficult to segregate them. The mill would be worth nothing where it stands without the water power, and the water power would be valueless without the mill.

Q. But, in the figures which you have given, \$1,980,000, what portion would you calculate to be the value of the water power?

A. I made no calculation, because I did not deem it necessary.

Q. Just look over them and tell me.

A. No, I will not. I gave you these figures, and, as I stated, they are the amount for which these mills have changed hands, and the amount of money that has been expended upon them; the figures I gave making the gross amount. As to the cost of the Eureka mill, I know what it will be when completed. That is why I gave it.

Q. The others are estimated in the same manner. The intrinsic value of the mills and mill-sites?

A. Precisely.

Q. If I understand you correctly, a large portion of the amount is the value of the power itself?

A. I state now, as I stated before, that the mill is valueless without the water power, and the water power is valueless without the mill.

Q. In giving these figures as you have given them, I want to know whether the largest portion of this sum does not consist of the value of the water power itself?

A. No, sir; I think not. The Eureka mill alone will cost—building and dam, and all the machinery connected with it, without the water power in any shape or form—not less than \$350,000. With regard to the Mexican mill, the first amount paid for it by its present owners, together with the sum laid out upon it since that time, will run up to \$250,000. Hence the water power is not taken into consideration. The Morgan mill the same way, and also the Brunswick mill. They paid so much money for the mills.

Q. Would they sell for any such sum?

A. Well, sir, you could not buy them of the parties who own them for one dollar less.

Q. Can you now sell these mills for the amounts you have given here?

A. There is no one that wants them except the parties who now own them. I would have no use for a mill unless I had something to do with it.

Q. They belong to the Union Mill and Mining Company, do they not?

A. No, sir; the Morgan mill and the Mexican and

Brunswick mill belong to the Nevada Mill and Mining Company.

Q. What is that?

A. That is a company that has been recently organized there.

Q. Who are the owners?

A. I do not know exactly who the owners are.

Q. Does not Mr. Hayward own a very large interest—Hayward, of Hayward & Jones, (I presume Mr. Jones is interested with him?)

A. There are three of the largest mills on that list that do not belong to the Union Mill and Mining Company.

Q. In selling a mill—would you in selling those mills count the water power and the mill together? Do they ever sell the water power by itself, or the mill by itself?

A. I never heard of such a thing. They usually go together. It is like selling a steam-mill and taking the engine out to separate the two. The mill is not complete without power to drive it.

Q. What loss would it be to the owners of those mills if the site was furnished them at the mouth of the tunnel, and power for the same capacity, so they may put up either the new mills there or remove the old mills?

A. That I could not say, because I do not know anything about that. That is supposing things that I cannot arrive at satisfactorily to myself at all, and hence could not answer a question of that character.

Q. You say those mills would be of little value to anybody else but the owners of the mills there?

A. Yes, sir; they would be of little value lest some one purchased them who had a sufficient amount of ore to run them with.

Q. Do you mean to say by that, that the men who own those mills still manage to get ore sufficient to supply them?

A. There were times when they could not get it.

Q. How many companies are there that own the major-

ity of those mills along the river? There is the Nevada company you speak of, and what other company?

A. There is the Nevada, the Union Mill and Mining Company, the Birdsall—the Woodworth mill is owned by Flood & O'Brien.

Q. How many mills does the Nevada company own?

A. Three.

Q. How many does the Union Mill and Mining Company own?

A. They own altogether five mills.

Q. How many mills are there besides that?

A. The Vivian—owned by outside parties mostly—the Woodworth, and the Birdsall—three.

Q. Do you know who compose the Union Mill and Mining Company?

A. I do not exactly know. I know who did—a portion of the parties who did compose it.

Q. Do you not know who compose it now principally?

A. No, I cannot say that I do.

Q. Do you know that Mr. Sharon is a large owner?

A. Yes, sir.

Q. Mr. Ralston?

A. Yes, sir; he is reputed to be.

Q. Is not Mr. Mills president of the Bank of California?

A. Yes, sir.

Q. Are not they the owners or the whole property?

A. I think there is no interest outside of that.

Q. They are about the principal owners then?

A. So understood.

Q. Then the main owners are the president of the Bank of California, the cashier of the Bank of California, and Mr. Sharon, their agent at Virginia City?

A. Yes, sir; that is my understanding.

Q. And they are able to gather all the ore they want to supply those mills?

A. There have been times when they could not get all the ore they wanted by a good deal. The mines were not producing much at one time. The mines they owned a

controlling interest in, did not produce much. That occurred more times than once.

Q. What do you mean by stating that the fall of the tunnel would be one-third less than it is now—the fall from this dam to the tunnel would be one-third less than what the fall is now?

A. I took Surveyor General Day's statement for that. He says that it is 155 feet from the Mexican dam to the Franklin, and 100 feet from the dam that he surveys to a point opposite the mouth of the tunnel. I deduct 50 feet, because there are 150 feet in one case and 100 in the other.

Q. Suppose the dam to be constructed over 150 feet in height—

A. I say that it is a supposititious rule, that I don't like to work by. I cannot answer a question of that kind with satisfaction to myself.

Mr. SUTRO. I have not finished my question yet.

WITNESS. I supposed you had. You halted.

Q. I was supposing a dam to be constructed 150 feet in height, and the water carried to the mouth of the tunnel: we would get at the mouth of the tunnel a 250-foot fall. Would you not consider that more power than you could get from all the mills now?

A. As I said before, that is supposing a thing that I cannot give an intelligent answer to. Anything connected with facts, that I know of, I am very ready to answer, so far as my knowledge extends; but working by the rule of supposition I never do.

Q. This is the proposition we have here.

A. I could not tell what the result of that would be. I never heard of a dam being built 155 feet high. I never heard of such a thing.

Q. Are there any difficulties in the way of building one that high in a rocky gorge?

A. Yes, sir. I have built dams myself—two across the north middle fork of the American river, and we had a great deal of difficulty in raising one 20 feet high. We had a rocky bottom to go upon. We had all the water

turned out, and we went to work and put in a dam—such as we supposed, if I may so term it, would be fire proof, or in other words water proof.

Q. How could you turn the water when you have got rocky sides, like in the Carson river, which rises in some places one thousand feet high?

WITNESS. At what point?

Mr. SUTRO. Taking any point.

A. There is no such point.

Q. Is there any point between the Mexican mill and the Franklin mill to turn that river off?

A. Yes, sir, easily.

Q. Will you name the point?

A. The flumes that carry the water from the present dams on to the mills. It takes all the water that runs in the river and more besides, so that the bed of the river below the dam is as dry as that.

Q. Supposing the water to be taken out at that point at the Franklin mill, taken out on a level with that present mill—the present dam: you would get 100 feet of fall at the mouth of the tunnel. Supposing the water to be taken out in the flume at the Franklin dam, it would give us 100 feet fall at the mouth of the tunnel, at a point opposite the mouth of the tunnel, 50 feet below the mouth. Would not that give an immense amount of power there?

A. I think it would not give as much power as the way it is at present.

Q. How much power do they get from the Franklin dam now?

A. I do not recollect of more than 2 mills—3 mills; the Woodworth, the Birdsall, and the Rocky Point. They have got a power equal to about 280 tons per day.

Q. You do not consider the dam feasible at all—any kind of dam?

A. Oh, yes, I do.

Q. How high a dam could be made there?

A. I do not know. You could make a dam there almost anywhere.

Q. I thought you just stated you could not make it?

A. I did not say you could not make it.

Q. Could you make a dam 100 feet high?

A. I presume you could build a dam 100 feet high.

Q. I suppose you could build it 300 feet high?

A. In fact, I know of no limit to the height, with the exception of the money to be required, to build a dam of almost any height. I might build one as high as the Pyramids of Egypt.

Q. You are not an engineer, are you?

A. No, sir.

Q. You could not give us any figures of the thickness of a dam, required with a given pressure of water?

A. No, sir; I could build a dam for myself, but could not as an engineer. I could build one myself, without consulting any engineer.

Q. By MEMBER. How high is the Mexican dam?

A. I do not know the height of that. Ten or fifteen feet—not to exceed fifteen feet.

Q. What is the distance down to the mouth of the tunnel from the Franklin dam?

A. Five miles and a half.

Mr. SUTRO. Now, suppose we can construct a dam over 100 feet high. Let us suppose that case. Take out the water at the bottom of that dam—that is, at the present bed of the river at the Franklin mill—we would get a pressure then of 100 feet. We would then get the *reservoir* 100 feet high, would we not?

A. To satisfy you, I shall make an answer, but I would like to have it understood that it is not a direct answer, because this rule of supposition I never work upon, and hence I do not like to answer a supposititious case. If you and I were in common conversation together, and you should ask me a question of that character, I would be ready to reason the matter with you. As I am sitting here under oath, I do not like to answer a supposititious question. I heard a man once suppose what would be the result of two bodies, one immovable and the other irresistible, com-

ing in contact. I could give an answer to that with the same ease that I could to this.

Mr. SUTRO. We will drop this dam question, I think.

Q. What mills have reduced ore for the Chollar Potosi company during the last year. What does this report call for?

A. I do not think they are named there.

Q. Did any mill reduce any ore beside the Union Mill and Mining Company?

A. No.

Q. It was all reduced by the Union Mill and Mining Company mill?

A. No.

WITNESS. Do you mean for the year ending May 31, at the time that report gives the figures?

Mr. SUTRO. Yes, sir; June 1.

A. If there were any, the amount was so small it would be scarcely considered—two or three thousand tons perhaps.

Q. How many tons of ore were worked during that year?

A. If I am not mistaken, 83,775 tons is correct.

Q. How much did the Chollar Potosi company pay for milling that?

A. They paid \$1,005,300.

Q. How much was that a ton?

A. Twelve dollars per ton.

Q. And \$2 paid for hauling?

A. No, sir; the Chollar Potosi company paid nothing for hauling. That includes that, so that the real cost to the Chollar Potosi company was \$10. We had nothing to do with the hauling.

Q. I suppose you would have to pay for hauling?

A. They got \$12 for milling and hauling.

Q. How much do they charge for hauling?

A. I do not know. I have had no hauling done in years.

Q. How much do the other companies pay for hauling down to the river—any of them?

A. It is \$2 in the commissioners' report. I do not state that as a fact; but let that go.

Q. That leaves about \$10 per ton for milling. I would like to ask you what the price is for transportation down to the river?

A. I suppose for all hauling over the various sections, by railroad and by team, it would not exceed \$2 25.

Q. How much is it by railroad—about?

A. I really do not know. I could not tell you the cost. I never asked what they had charged by railroad. I never had any occasion.

Q. Is it over \$2?

A. Some mills make a little over \$2; there are others somewhat under.

Q. Would it not be an average of \$2?

A. Yes, sir; I should think it would.

Q. Then we get 83,775 tons on which your company paid for milling. You say it costs \$4 50 to mill?

A. On the river, I think so, at the present rate of working. According to the present modes, under the reorganization of some of the mills, they have increased their capacity very materially, and they can work ores cheaper than they could twelve months ago.

Q. Will you be kind enough to figure how much it would come to, milling 83,775 tons, at \$4 50 per ton?

A. I think the exact figuring about \$376,000—\$377,000 nearly.

Q. Taking the price paid at \$10 a ton, how much difference does that make?

A. That would be \$837,750: \$377,000 deducted from that leaves \$460,000.

Q. Then the Chollar Potosi company paid a profit to the Union Milling company of \$460,000 in one year?

A. No, I think not. They did not work it all by water power. There was steam power used on a great deal of the ore. We had worked out 83,775 tons.

Q. What proportion?

A. Over two-thirds of the work by steam power.

Q. What is the actual cost of milling by steam power?

A. I think they have got it reduced now to \$6, may be, in a good mill.

Q. Now, will you be kind enough to make your figures on two-thirds by steam power and one-third by water power?

A. You make the figures, and I will do the calculation.

Q. If you will state my figures are correct?

WITNESS. You know better what you want to figure than I do.

Mr. SUTRO. It is very simple?

WITNESS. I know it is very simple.

Q. By water power, 27,125 tons; by steam power, 55,850 tons. You paid \$12 for all that ore?

A. Yes, sir.

Q. They made \$5.50 per ton profit on the water power, did they not? And you say it costs \$6 by steam power. They would have made \$4 per ton there, would they not?

A. If it did not cost any more than \$6, they would.

Q. Will you be kind enough to state how much that comes to at \$5.50 and at \$4.50? One-third at \$5.50 and two at \$4.50.

A. The one, by \$4.50, comes to \$223,392; by \$5.50, \$153,598.

Q. How much would that be altogether?

A. \$376,990.

Q. Then your company, the Chollar Potosi, has paid a profit to the Union Mill and Mining Company of \$376,990?

A. No, sir; I think not. I think there is a great deal of wear and tear connected with the mills.

Q. You did not figure that in?

A. No, sir; you asked me what it took to do it, and I gave it to you.

Q. In reducing the ore, must not you include the wear and tear of your mills?

A. No, sir.

Q. How much do you think that amounts to?

A. In connection with that, they paid the Chollar Potosi company a reclamation of from \$16,000 to \$17,000.

Mr. SUTRO. That has nothing to do with this matter. I want to know whether you are going to make any further reductions?

A. I do not propose to make any reduction. I am not making these figures myself. I say that when the matter of \$4 per ton is considered, it is considered that they reduce the ore for that; but when the mill is worn out, they rebuild it. You know as well as I do that a mill wears out, and you know that when you turn to and work one, you figure it, for instance, as to what it has cost per month. You keep that up for a series of months, and then you have to undertake a pretty thorough overhauling again, and so you keep going. Some mills wear more than others. Some are subjected to more accidents than others, and consequently it costs a great deal more money to run some than others.

Q. How much would that amount to. You are an expert at milling. Will you state, if you please, how much that wear and tear would come to besides the cost—the actual cost?

A. I am not prepared to answer about that to-night, because I want to think it over.

Q. No time is given me for asking you any questions. Mr. Sunderland has just gone through with your examination, and I do not see why you should not be able, as an experienced mill man—you say you have been mining and milling for 22 years—to give me those figures. What is the fact?

A. I have not done any milling for five years, and a man, as a rule, when he is not in actual practice, gets somewhat rusty. That is about the position I occupy to-night. I am slightly rusty upon that proposition of figuring down accurately the wear and tear of a mill.

Q. Do you mean to say that the Chollar Potosi mine did not pay a profit in one single year to the Bank of Califor-

nia, or parties owning the Union Mill and Mining Company, of \$376,990?

A. No, sir. In my opinion, take out the wear and tear, it did not pay that sum.

Q. How much profit do you think they paid?

A. Well, sir, as I stated before, I would like to figure that a little. I am not carrying on a casual conversation with Mr. Sutro.

Mr. SUTRO. No, you are giving your testimony under oath.

WITNESS. Consequently I want to be as near the truth as possible, and I intend to get there.

Q. Do you think it would amount to 10 per cent. on all that money—10 per cent. on the whole amount paid?

A. If you give me a little time to think over that, I can figure it out in the course of the next twenty-four hours, and then I will give you an answer which will be satisfactory to yourself.

Mr. SUTRO. I will have to dismiss that point.

WITNESS. I have done no milling for five years. I have not been a milling superintendent for five years, and I have become a little rusty.

Q. I want to ask you who the trustees of the Chollar Potosi Mining Company are?

A. A. K. P. Harmon, J. D. Fry, A. Hayward, William Norris, H. C. Kibby, James Freeborn, Robert Sherwood, trustees. The president is A. K. P. Harmon; vice president, J. D. Fry; secretary, W. E. Dean; superintendent, Isaac L. Requa.

Q. Who is the treasurer of your company?

A. We have no treasurer, I think.

Q. Who keeps your money?

A. Well, sir, the company keep it. The president, I think, deposits it.

Q. Whom do you draw on in San Francisco?

A. The president of the company.

Q. Where does he keep his money?

A. My understanding is, it is kept in the Bank of California. Still I do not know that.

Q. It is a well-known fact.

A. I do not know it well enough to swear to it.

Q. Let me ask you whether Mr. Harmon, your president, is not closely connected with the Bank of California?

WITNESS. In what sense?

Q. Is he not a stockholder there?

A. No, sir.

Q. Is he not connected with the Bank of California?

Mr. SUNDERLAND. I object.

By Mr. KENDALL:

Q. Can you answer the question approximately as to the wear and tear?

A. I cannot exactly at the present time.

Q. State, if you can approximately, what that deduction ought to be for the wear and tear of the machinery.

A. I cannot very well now. I do not know that I can get at it accurately.

Q. Is it 10 per cent.?

A. I do not know.

Q. Do you think it is 15 per cent.?

A. I say, if I can have a little opportunity to think it over and refresh my memory, I will try and give an answer. I do not want to give a vague answer. I would like very much to give answers that I am satisfied are very nearly or quite correct. So far as I have gone, I have endeavored to do so in this matter. I stated before that I have been out of practice for five or six years, and one naturally becomes a little rusty.

Q. You are a mill man of some experience?

A. I have been.

Q. What generally is the per centage of loss, by wear and tear of mills and machinery and buildings, according to your experience and observation? You can tell that, of course, pretty nearly. That is directly in your line of business?

A. Not for five years. When I was running quartz mills I could have answered that question just as promptly as any one; but, as I have stated before, I have not run a mill and have not made any calculation about the cost of wear and tear for some five years, and it will take me a little time to collect my thoughts before I could give an approximate estimate. At present I do not feel myself able to approximate.

By Mr. SUTRO:

Q. You do not know about the connection of Mr. Harmon with the Bank of California?

A. In what sense?

Q. If Mr. Harmon owns any stock in the Bank of California?

A. That is a question I say I cannot answer. My impression is that he does not.

Q. Do you know who Mr. Fry is?

A. Yes, sir.

Q. What relation is he to Mr. Ralston?

A. I think Mr. Ralston's wife is somewhat connected with Mr. Fry. He belongs to the family.

Q. Do you know whether Mr. William Norris is a director in the Bank of California or not?

A. I do not know whether he is or not. They have a number of directors.

Q. Do you not know that he is a director now; that it is well known to everybody, and has been for years?

A. It is not to me. They change the directors every year. These directors are not the same directors to-day that were there some time ago.

Q. Do you say that you are not sufficiently acquainted with the Bank of California to know its directors?

A. I have so stated. I could not name two directors connected with the Bank of California positively.

Q. Do you know Mr. James Freeborn?

A. I do.

Q. Is he not a broker of the Bank of California?

A. I don't know any such thing.

Q. Is it not a well-known fact that he does the brokerage for the Bank of California?

A. Not to my knowledge. I never heard of it.

Q. Do you know Mr. Freeborn well?

A. I know him.

Q. Do you know he is a broker?

A. I know he has been. I do not know what he is to-day. He has been a broker for a good many years.

Q. Do you mean to say that you never heard of his doing any stock transactions for the Bank of California?

A. I mean to say I never heard of his attending to any stock transactions for the Bank of California.

Q. Do you know what connection Mr. H. C. Kibbe has with the bank?

A. No, sir; I do not.

Q. Do you know whether Mr. Hayward used to be a director in the Bank of California?

A. I do not know that, but I presume so. I am told that he has owned a great deal of stock.

Q. They have had a little falling out?

A. Not that I am aware of.

Q. Is he still a director in the bank?

A. If he ever was, I suppose he is to-day.

Q. Do you know anything about Mr. Sharon? Tell me whether he has any connection with them?

A. Not any. I do not know of any.

Q. Has not Mr. Sharon a great deal to say about your mine?

A. No, sir.

Q. Have you ever consulted him?

A. No, sir.

Q. Did you ever communicate with him about the state of the mine?

A. Sometimes. He, like a good many other men, would ask me how the mine looked, and I would always give him all the information I had.

Q. Is he a stockholder in the mine?

A. I presume he owns stock. There have been times,

though, when he owned nearly all the stock that the mine consisted of. At the last annual election I do not think the Bank of California owned a share, but I think Mr. Sharon and others and myself included did. We voted about 26,000 out of the 28,000 shares.

Q. Who owned them?

A. The mill company, Mr. Sharon individually, the president, and myself.

Q. At that time the mine was in a very fine condition, was it not?

A. Not as fine as it had been.

Q. How much do they own now?

A. I am not able to state.

Q. Do they own as much now as then?

A. They may and may not. I do not know.

Q. Did they not sell out before the stock went down?

A. That I have no knowledge of. I do not think they did. I am sure they did not.

Q. How much stock do you own in the Potosi mine?

A. That is a question I do not think it is necessary to answer here. That is my private business. I am not examined upon that.

Q. How much salary do you get as superintendent?

MR. SUNDERLAND. I submit that there is no sense in that or similar questions.

MR. SUTRO. I will state that it is of the highest importance to ascertain the position of these gentlemen. They come here to testify against the tunnel—at least they are opposed to the tunnel—they are opposed to the construction of the tunnel, as far as they or the parties who send them here are concerned. If I understand it correctly, it is very desirable to ascertain who these gentlemen are, and what interest they have in opposing it; whether the construction of that tunnel will bring about a new state of affairs; a new manner of reducing ores, the establishment of new mills, the consequent effect of which will be to put these men out. Such being the case, it is natural that they should seek to uphold the most expensive system of mining and milling,

inasmuch as they make hundreds of thousands and millions of dollars out of it. They are opposed to the tunnel because they derive all the profits from the work of these mines; and I have already shown by the other witnesses, that those mines are worked in the interest of the rings—men who own the mills. They are making the money, and the stockholders are not, and it is essential to find out these facts. I want to ask the witness a few questions in regard to his position, and I would like to know how much salary he gets as superintendent of that mine.

WITNESS. I would like to state that Mr. Sutro makes a pretty broad assertion when he says that the stockholders get nothing out of this. We divided up \$2,000,000 last year. I would like to say that the Chollar Potosi company were declaring \$10 in dividends per share per month. The stock was selling not to exceed \$90 per share, and for the whole year we declared \$70 per share in dividends, and the parties who owned it got the benefit, to my certain knowledge. I wish to say further, that the Chollar Potosi company has declared forty-seven consecutive dividends, and the stockholders got them—who they were I am not prepared to say—and that the stock has paid in dividends, since I have managed the mines, nearly \$100 per share, and during that time it has never reached the price of \$100 per share.

Mr. SUTRO. You are making a statement here——

WITNESS. Which I am prepared to substantiate by my oath.

Mr. SUTRO. I do not dispute any of your statements now. I take all that you give; but I want your figures and returns in regard to it.

WITNESS. As far as I can, I propose to give them to you.

Mr. SUTRO. You stated that the stock never went over \$90, and yet you paid \$10 per share per month in dividends?

WITNESS. Yes, sir; for five consecutive months.

Q. How much per cent. is that a month?

A. That would be 10 per cent. on \$100—11 per cent.

Q. What is the reason the public did not pay more than \$90?

A. Because the public had no faith in the mine.

Mr. SUTRO. Because it was managed by a ring and because the public had no confidence, or they would not have shut down upon it.

Mr. SUNDERLAND. I protest against this abuse by Mr. Sutro of everybody but himself. I propose to attack Mr. Sutro to show who and what he is.

Mr. SUTRO. You are welcome to do that.

Mr. KENDALL. I do not think there need be any such feeling in this examination as is exhibited sometimes.

WITNESS. I have not exhibited any feeling.

Mr. KENDALL. I did not say who.

Mr. SUNDERLAND. I cannot sit here, Mr. Chairman, and hear my friends abused, when I know the insinuations against them are false.

The CHAIRMAN. These things will not weigh with the committee.

Mr. SUNDERLAND. I suppose they will be reported, however, by the committee with the testimony in the case?

The CHAIRMAN. The question has been asked, and, if the gentleman objects, we will decide it?

Mr. SUNDERLAND. I have been objecting until I thought I was wearying the committee. I certainly have wearied myself by objecting to all this illegal evidence.

Mr. SUTRO. I want to ask the witness this question: Why has this stock never gone beyond \$90 per share, when it was paying \$10 dividends per month or 11 per centum per month?

Mr. SUNDERLAND. I object.

The CHAIRMAN. Why, he has already answered that question.

Mr. SUTRO. I do not see any objection to that, Mr. Sunderland.

The CHAIRMAN. He has answered the question by saying that the public had no confidence in the lode at that time.

WITNESS. I will state, Mr. Chairman, that the lode had run down and looked very bad from one end of it to the other. The production was very limited indeed, but we had the good fortune in the Chollar Potosi to strike a very fine deposit. The public at large, I think, almost universally had failed to give the mines much attention. They thought there was no value left in them, and hence, when we struck this fine deposit in the Chollar Potosi mine, although we shipped so much bullion and made it public, and every shipment was seen and known by those who chose to know it, yet they regarded it as a surface deposit. Yes, they regarded it as nothing but a surface deposit and as not amounting to anything. The stock was not selling for much, and they did not care to purchase it. I will say to Mr. Sutro that, if he was in California, he would not be obliged to buy an inch of stock unless he chose to do so, and I undertake to say that the stockholders of the Chollar Potosi—I only speak for that mine—will say that they have been as well treated upon the coast, and as well suited with their investment, as any they have made, unless I am very much mistaken. I wish he (the chairman) would come there. I would like to have him investigate the thing in person.

The CHAIRMAN. Proceed, Mr. Sutro.

Q. What is the usual interest on the Pacific coast?

A. They calculate that mines ought to pay 5 per cent. per month.

Q. What is the usual interest in San Francisco?

A. I see it stated in the papers that large loans upon real estate have been made at 1 per cent. per month, or 10 per cent. a year; but the rule in regard to mining stock is, that most people who talk about dividends think they ought to have about 5 per cent. per month on such.

Q. The Chollar Potosi mine, you say, paid interest during the whole year at the rate of 11 per cent. per month?

A. Not for the whole year. I say five consecutive months.

Q. I want now to repeat the question that I put to you before the interruption: How much salary do you get?

A. As that is a private matter, not connected with this investigation in any manner, shape, or form, I would like if the Chairman——

The CHAIRMAN. I suppose the object is to show the interest of the company—the relation of the company.

WITNESS. I would like to state that whatever it costs for operating the mine can be found here in detail in this report.

Q. Does that state the salary of the superintendent?

A. No, sir; not alone.

Mr. SUTRO. You refuse to answer that question?

A. No, sir; I do not refuse to answer. I say to the chairman it is a matter of private business of my own; that I do not understand I am being examined as to my private affairs.

Mr. SUTRO. This has a close connection, and you appear here as a witness.

The CHAIRMAN. You object to the question, Mr. Sunderland?

Mr. SUNDERLAND. I suppose that objection still stands.

Mr. RICE. I wish to say simply that the committee will bear in mind that this is a cross-examination. This is a different examination from what we have had from these government officers who come here. This is a witness who has come here thousands of miles, in the midst of winter, voluntarily, to give his testimony against us, and we have a right to assume that he is an interested witness, and we wish to show these facts. We wish to show what his interest is. This is a cross-examination, and all of you gentlemen know that great latitude is allowed in cross-examination.

The CHAIRMAN. Certainly.

Mr. SUNDERLAND. I admit it is true that Mr. Requa is a stockholder in the Chollar Potosi company. If that is all, we admit that; but I propose to object to any question as regards the amount of salary that he is receiving.

The CHAIRMAN. This is for the purpose of showing whether the witness is biased or not.

Mr. KENDALL. I am clearly of opinion that this line of cross-examination would be permissible in any court, to show the interest of a party in a matter.

The WITNESS. Mr. Kendall, I do not object to answering it: I simply say that if I answer one, that will lead to another. I do not propose to make an exhibit of my private affairs here.

Mr. KENDALL. Of course there is a limit to it. I think Mr. Sunderland will admit himself that it is a line of examination admissible under the law.

Mr. SUNDERLAND. It is admitted that he has an interest. They want to show how far—what degree of interest he has.

Mr. KENDALL. I confess that I want to know myself, as a member of the committee. I frankly say that. I make no concealment of it. I want to know to what degree the witness is interested in matters he is testifying to, not by any means doubting his truthfulness.

The WITNESS. The objection that has been made will be for the committee to decide, of course; but I have no objection to telling the committee what I get as a salary, with the one exception, that I do not think I am compelled to make an exhibit of my private affairs here. That is all. I cannot see that I am. But if the committee decide that I must answer the question, of course I will answer them up to the point where it gets down to my own pocket, and then the committee will not insist upon that.

Mr. SUTRO. On that subject it is stated by the committee that they desire an answer to the question.

The CHAIRMAN. No, they have not so decided yet.

Mr. SHOBER. My view of this examination is, that it is a cross-examination, for the purpose of showing any interest of the party in the matter being investigated. I agree with Mr. Kendall that such a question would be pertinent as to the extent of interest that Mr. Requa may have in the mine. Of course I think it might be limited, though. I do not think we should go into all of Mr. Requa's private affairs,

by any means. I think the question is proper, under the circumstances, although I do not consider it has a very great bearing one way or the other, in my mind.

The CHAIRMAN. Well, you have heard what the members of the committee have said; you must answer the question.

The WITNESS. My salary is \$500 per month.

Mr. SUTRO. What are your other perquisites?

A. I am not aware that I have any.

Q. Does not the company furnish you a house?

A. Yes, sir.

Q. Furnish any servants?

A. No, sir.

Q. Furnish any horses?

A. No, sir; I furnish my own horses.

Q. Who takes care of your horses?

A. The company pays for that.

Q. Have you speculated in stocks since you have been superintendent in that company?

A. That is another question that I conceive is connected with my private affairs, and I do not think I ought to answer.

Q. How much stock do you own in the company?

A. I cannot understand why I should answer that question.

Mr. SUTRO. I wish to state that this is one of the most significant questions that has been asked in this whole examination.

The CHAIRMAN. Mr. Requa has already stated that he owns stock in the company, but has not stated how much he owns.

Mr. SUNDERLAND. Suppose he wants to telegraph tomorrow to sell his stock, or to buy, is it proper that the amount of his stock and all this should be exposed here? I do not know whether Mr. Requa wants to sell the stock he has or wants to buy more, but, under what rule, in God's name, can you call on a man to know how much stock he has? Suppose he has 500 shares of stock, or suppose he has 5,000 shares, the only question is whether he

is telling the truth—whether he has an interest to tell the truth or to swear to a lie. Now, he admits that he is interested. Is not that all they can ask? The question of the amount of interest never was asked in any court of justice in the world.

Mr. SUTRO. I desire to state that the interest which this gentleman owns in that mine is a matter very necessary to understand and know. Without questioning the statement of Mr. Requa at all, it is important to know to what extent he is interested, and to what extent he is operating in this stock. That is a fair question to ask, and it is a very important one to know.

The WITNESS. I have stated, Mr. Sutro, that I was not opposed to your tunnel. You may run it, as far as I am concerned. I have no opposition to make to the tunnel at all. My answers were direct answers to the questions of Mr. Sunderland. There is nothing in those questions conveying the impression that I am opposed to the running of the Sutro tunnel.

Mr. SUTRO. Mr. Requa may not personally be opposed to the tunnel, but the persons who employ him may be. It may be that they are deriving, as they are, large profits annually out of the working and milling of the ores, and it is very important to understand in what position Mr. Requa himself is.

The CHAIRMAN. I think it is proper for him to state the amount of his interest aside from his salary, which I suppose will be the amount of his stock.

The WITNESS. Does the chair decide I must answer as to the number of shares of stock I own.

The CHAIRMAN. Yes, sir.

The WITNESS. As I stated, I was not opposed to the running of the tunnel, if Mr. Sutro will only run this tunnel with his own money. I have not the slightest objection in the world to it, but I do object to being taxed myself, by way of having the United States Government aid in this enterprise, and thus throwing money away.

Mr. RICE. Is that an answer to the question?

WITNESS. No; I am talking to the chairman about it. I am not opposed to the tunnel, but I am opposed to giving answers as to my private affairs.

Q. What is the amount of the capital stock of the company?

A. There are 28,000 shares of \$100 per share, making \$2,800,000. If it is positively necessary—if the chairman decides I must answer the question—I will do so.

The CHAIRMAN. It is a proper question.

The WITNESS. I may own stock to-day and may not own it to-morrow.

Mr. SUTRO. My question is how much you owned when you left Virginia City?

A. That would not exceed 250 shares.

Q. How many shares in the Chollar Potosi mine have you bought and sold since you became superintendent?

Mr. SUNDERLAND. I object.

Mr. SUTRO. May it please the committee, it is absolutely necessary to arrive at that fact. If the superintendent speculates in stock, it is very important to show the fact.

WITNESS. Mr. Chairman I have bought a great deal of other stock besides that.

Mr. SUTRO. I am only asking how many shares of stock you bought and sold.

WITNESS. I could not tell. I could not make an approximation.

Mr. SUTRO. How much money have you made out of the stock since you became superintendent?

Mr. SUNDERLAND. I object.

Mr. SUTRO. It is very important.

Mr. SUNDERLAND. Mr. Chairman, it is perfectly ridiculous that Mr. Sutro should say to everything that he wants to ask, no matter what it is, that it is very important, and urge its reception on that ground. Is everything to be received simply because he says it is important?

Mr. SUTRO. Mr. Chairman, it is reputed out there that Mr. Requa, since he has been superintendent, has made \$400,000 or \$500,000 by speculation in stocks. I would

like to ascertain whether the superintendent in that mine, who is acting for all parties, has speculated largely in that stock, and made any such sum of money.

Mr. SUNDERLAND. It would be just as pertinent to know what speculation Mr. Sutro has made in the stock, and how much stock he has got for nothing in the Sutro Tunnel Company.

The CHAIRMAN. What do you claim its bearing to be on this question?

Mr. SUTRO. It is this: that the present mode of working the mines is such, that only one portion of the mine is open at a time, and consequently the condition of the mine is kept in the dark, and the result is there is a stock-jobbing operation going on constantly. When ores are discovered, of course the superintendent has the first knowledge, and he can telegraph and buy the stock from the stockholders, whom he represents as superintendent. He buys their stock at a low figure. The stock goes up, and he derives the benefit which ought to belong to all the stockholders alike. And if this tunnel laid all these affairs of the mine open, as a consequence, none of the stock-jobbing could go on—at least not to any such extent as is done now—and consequently I would like to know how much money he has made during the time that he has been superintendent of the Chollar Potosi mine.

The CHAIRMAN. Would strangers have any right to go in and examine the mine if connected with the tunnel?

Mr. SUTRO. It has been a rule when a strike is made to keep outsiders out.

The CHAIRMAN. That would be a privilege of the company?

WITNESS. It has never been practiced at the Chollar Potosi mine. A man is at liberty to go into the mine whenever he asks to. At the time we were working this large body of ore we invited people to go there.

Mr. SUTRO. Why do you object to answering this question?

A. Because it is my private business.

Mr. SUNDERLAND. On Friday evening there was an effort made by me to try to get up something about the Sutro Tunnel Company—something as to its origin; its stock; the disposition of the stock. The amount of more than one-half of the stock has been placed in the hands of parties to be floated all over this city, and all over the country, to manufacture public opinion in favor of it, and I, perhaps, ought to say that—

Mr. SUTRO. That is not correct.

Mr. SUNDERLAND. But yet Mr. Sutro and his attorneys have successfully resisted that inquiry, and the committee would not let us show what was done with the stock. Here is the report made by the superintendent of the Sutro Tunnel Company. That up to July 1 they had spent \$42,800. They have been running that tunnel for the last six years. It has been published in the newspapers from that time to this that the tunnel had got on so far. Mr. Sutro published over his own signature, in a pamphlet, two years ago, that at that time 1,100 feet of that tunnel were completed, and yet, up to the 1st of last July \$42,800 had been expended, and yet \$7,000,000 of this stock, unassessable, full paid, without consideration, has been issued by that company. Now, when this company refuses to allow me to inquire into that, it is proposed to inquire of the witness that we place upon the stand what stocks he has bought, and what he has sold, and whether he has lost or made by the transaction; and it is called a stock-jobbing operation on the part of the superintendent of the mine, who is a witness on the stand. If ever any stock-jobbing operation was made that was disgraceful, it is this stock-jobbing in connection with the Sutro Tunnel Company.

Mr. RICE. I would like to say one word in regard to this. I do not like to have any misunderstanding or misrepresentation about this, so far as I am concerned. The facts in regard to ruling out certain testimony last evening were simply these: that we had a Government witness here not

called by us, but called by the committee through the Secretary of War. He came here as a Government witness.

Mr. SUNDERLAND. At your request.

Mr. RICE. And testified in full on one side and the other. He was dismissed without any intimation that he was to be again called. He was brought back here by Mr. Sunderland to correct his testimony, as he said, and then, when we objected in the commencement that he should not go into new matter—that, he having been fully examined on the one side and the other, and his testimony closed, it was contrary to all rules to go into new evidence, and upon that ground the paper which he proposed to submit was ruled out by the committee, General Foster refusing to let us examine it, and see what it was, contrary to all rule. Now, we say there is nothing in that paper that we object to, and we desire the committee to bring it here, and put it into the case.

Mr. SUTRO. We have agreed it should be put in, though it has no sort of relevancy to this case at all.

Mr. RICE. It is now proposed to ask of an interested witness what interest he has in these mines and mills and in these operations, and we are at once met with anger and with objections. I say it is entirely a different case, because the other was a Government witness, and this an interested witness who comes here.

Mr. SUTRO. If these stock transactions can afford to see daylight, I do not see why so much feeling should be exhibited every time any allusion is made to the Bank of California. Whenever a question is asked in regard to it, an unusual feeling is exhibited here—when we ask such a simple question as will be allowed in any court of law.

The CHAIRMAN. I think we understand the question now, Mr. Sutro. The committee, I believe, decided the other evening, all in consultation, that they would receive the statement the next day, if it was desired to have it.

Mr. SUNDERLAND. That was rejected, I know, by the committee once.

The CHAIRMAN. I do not know that we ruled against it;

but it was not decided one way or the other—it was a new question.

Mr. RICE. It was distinctly left open.

The CHAIRMAN. It was understood that, if we concluded to receive it on sending such information to General Foster, he would return it. I think that was the way it was left.

Mr. SUTRO. Does the witness refuse to answer?

The CHAIRMAN. We have not decided that point yet.

Mr. SUTRO. I will state my question again. It is this: How many shares of stock Mr. Requa has bought and sold since he has been superintendent?

Mr. SUNDERLAND. I desire to have an objection noted to that question.

The CHAIRMAN. He has stated here that he cannot tell how many shares of stock he bought and sold.

The WITNESS. Nor how much money I made out of it. I bought stock of all kinds. Sometimes I would make some money, and sometimes I would lose. It is simply out of the question for one to tell what and how.

Mr. SUTRO. Let me ask you, then, have you been in the habit of dealing in stock in the Chollar Potosi mine?

A. No more in the habit in that than in any other. Often the stock goes down and goes up again, and I neither buy nor sell.

Q. It is reported out there that you have made a very large amount of money in these stock operations, in buying and selling stock in the Chollar Potosi mine. Do you mean to say you have not?

Mr. SUNDERLAND. I object.

The CHAIRMAN. I think it will be proper for you to state whether you have dealt largely, or generally, in that stock connected with the stock of your mine.

The WITNESS. Generally, I have not dealt in that any more than I have in others; largely, no more in that than in others.

Q. You cannot state the whole extent?

A. No, sir; that would simply be out of the question. I could not tell by any way on earth. I kept a record for a

season, and then I destroyed it. I am a fortunate possessor of a small sum of money; that I do not deny, but I have not made it all in the Comstock. I have bought stock in San Francisco, and some in New York. I have, as I stated before, been a little fortunate, and got a small sum of money together, but it has not been confined to buying the Comstock stocks. It has not been confined to the Chollar Potosi stocks. I have loaned some money, and got a good rate of interest, with good security.

Q. I want to ask you now, whether you bought any stock in the Chollar Potosi mine before that great rise in the value of stock?

Mr. SUNDERLAND. Is there to be any end to this examination?

The CHAIRMAN. I hope we shall reach an end by and by.

Q. I want to ask you whether you consider it fair for a superintendent, with his superior knowledge of the condition of the mine, to buy stock at a time when he knows he is bound to gain by it, and thus get the stock away from the stockholders whom he represents, and deprive them of the benefits which they ought to get from the rise of stock?

A. A man managing any enterprise, I do not care what it is, who sees an opportunity to make money honestly, has a perfect right to do it, in my opinion.

Q. What year was that railroad constructed?

A. It has been completed about two years. I guess somewhere about 1869. I am not positive as to the exact date. I did not have any interest in the railroad, and did not keep any run of that any more than I did of a great many other affairs.

Q. Do you know when these contracts were made with the tunnel company by the mining companies?

A. Yes, sir; I know when they were made, and I positively refused to sign myself. I was a trustee of the Belcher company. If Mr. Sutro can find my name in that book, I would like to see it.

Q. The signature of the president of the Chollar Potosi company to that contract was acknowledged on the 20th of April, 1866.

A. I was not superintendent of the Chollar Potosi at that time.

Q. I ask you if you know when that was signed?

A. I told you I did. I was trustee of the Belcher company, and was solicited to sign the document for the running of that tunnel, which I positively refused to do.

Q. Did not the Chollar Potosi company make a contract to suit the tunnel company?

A. I do not know anything about that. I was not superintendent.

Q. Do you know at what time this law passed Congress, authorizing the construction of this tunnel?

A. No, sir.

Q. It is on record here; it was on the 25th July, 1866.

A. I have not examined it very closely.

Q. Consequently that railroad was started some four years after the tunnel had been authorized to be constructed, was it not?

A. If there was everything correct—if my ideas are correct about the time it started—it would be about three or four years difference.

Q. Was not that railroad company started with the full knowledge of the existence of this law authorizing the construction of that tunnel?

A. I could not tell you that; I presume so.

Q. Did the Union Mill and Mining Company own any mills on the Carson river on the 25th July, 1866?

A. That is a question I cannot answer, for I do not know.

Q. Did it exist at all—the Union Mill and Mining Company—in 1866?

A. That I cannot answer. I do not know now when it did first start.

Q. When do you think it started? About what year?

A. I should guess they had what was called the Union

Mill and Mining Company; that they had some property, especially of mills, on the river in 1866. That is my recollection. I may be at fault there.

Q. Did it have more than one mill?

A. I could not say. I have only a vague idea. I do not know whether they acquired these mills pretty much after the construction of this tunnel was authorized by Congress or not. I do not know how long they have owned them. That is the real fact about it.

Q. You say the mills properly on the Carson river would be destroyed entirely by the construction of that large dam?

A. If the dam was constructed, and was made tight, and held the water to the very top, it would destroy about all that mill power.

Q. Would it destroy their mill power, provided they were furnished with mill power at the mouth of the tunnel?

A. I do not see how they would get mill power at the mouth of the tunnel—that is, any number of mills; any great amount of power—because of the construction of the dam.

Q. If the dam were constructed, and were full of water, and there was water enough to run over the top of it, you would get 254 feet fall at the mouth of the tunnel, then, would you not? Suppose you get that fall, how much horse power would that be?

A. I am not prepared to answer that.

Q. Do you doubt the statement of Surveyor General Day made here?

A. I have not looked at it.

Q. Please look at it.

A. I have no reason to doubt Surveyor General Day.

Q. Do you know how to figure horse power?

A. Yes, sir.

Q. You have stated that the railroad would not pay if the tunnel is constructed?

A. If the tunnel was constructed upon the place talked of, and the town moved away, I do not see what the railroad would have to do.

Q. Should they complain if the railroad became valueless, when it is known they built it right in the face of the law authorizing the construction of the tunnel? State whether these people can make any just complaint.

The WITNESS. What people?

Mr. SUTRO. The people of this railroad.

The WITNESS. Can they do what?

Mr. SUTRO. Whether they can make any just complaint if their railroad becomes valueless, when it is known that they built it after this law passed authorizing the construction of the tunnel?

Mr. SUNDERLAND. I object to the question, Mr. Chairman. That is not a fact. The witness is brought here to prove facts.

Mr. SUTRO. The witness has stated the railroad was constructed long after the tunnel was authorized to be.

Mr. KENDALL. I think the objection is tenable; it is merely calling for the opinion of the witness. The fact is brought out as to the relative points of time that these works were commenced.

Mr. SHOBER. The facts leading to that deduction have been brought out, and the witness is made to make an argument upon it. I do not think that is proper.

Mr. SUTRO. I withdraw that question.

Q. You have stated that if that dam be constructed, it would destroy Carson City?

A. That would be my opinion.

Q. Do you know how far it would dam up the water?

A. According to Surveyor General Day, if the dam be constructed, it must be carried up to the Mexican dam or beyond it.

Q. How high does the water stand there at the foot of the Mexican dam?

A. I suppose it would be very deep at that point.

Q. How deep would it be?

A. I can not tell.

Q. Suppose the water should rise 2 or 3 feet, or 15 feet, or 10 feet higher than the level of that bank, do you say

there would be any difficulty in making a levee there to keep the water off?

A. That is a supposititious rule, and I decline to answer these questions; but I cannot tell. If I was on the ground to look at it, I would form some opinion.

Q. Have you not stated the tunnel would be of no use? Is not that a supposititious question?

A. No, sir; because I have mined at 1,250 feet in depth. I gave you the figures there—the positive things that do exist; the others I know nothing about. I claim no knowledge of those other things, and I say it is a supposition.

Q. You have stated that the health is very bad on Carson river, and fever and ague prevail there, and some of the families have had to leave the mills there in consequence.

A. Yes, sir.

Q. Are you aware of the fact that they have been working at the tunnel two years and half, and have not had a single case of sickness amongst all the men or their families there?

A. I am not aware of that fact.

Q. Have you ever been to the mouth of the tunnel?

A. I never was at the mouth of the tunnel. I was down once at the point where it was said to start from, but have never been there since.

Q. Do you know that the mouth of the tunnel is 154 feet above Carson River and a mile and a half away from it?

A. I know it from what Surveyor General Day says; I know no more. I should guess it to be a mile, fully, away from it, as my recollection is of the point that it is said to start from. The height would, I suppose, be necessarily at least that. The height to dump the debris—without that you could not very well dump it. So I believe that my conclusions are that you are perfectly correct in this statement. At least I would think so.

Q. Is not there a slope from there down to the river?

A. Yes, sir; a gradual descent.

Q. You have stated that some of the people of the Franklin mill had to leave?

A. Yes, sir.

Q. Is not the Franklin mill built right in the river almost?

A. No, sir; it would not do to build it in the river. It is built along the side of the river, more than 10 or 12 feet above the river, high enough to avoid all the deluge.

Q. If there be any fever there, would there likely be any fever on the elevated place a mile and a half away from the river?

A. I have heard of rivers of that kind creating fever and ague for more than a mile and a half from it, from persons living in the vicinity, and within two or three miles.

Q. Is it not well known that one of the healthiest spots in Nevada is right there?

A. I do not know it. I am not prepared to dispute it, however.

Q. You have stated here that 90 per cent. is saved out of the ore that is worked.

A. That is my belief.

Q. How much of that do the companies get?

MR. SUNDERLAND. I object to that. It does not make any difference. If there is any object in running this tunnel at all, it would not make any difference what the mining companies get, so far as the Government at large is concerned in saving as much as possible from the ore.

THE CHAIRMAN. I cannot see, perhaps at first, the exact bearing of all these questions.

MR. SUNDERLAND. The bearing is, instead of the present parties who run the mills and save the tailings, and get the profits resulting from that, that Mr. Sutro wants the profits. That is the idea.

MR. SUTRO. We have spent hours on that very question, and I want to ask Mr. Requa how much that company has received from the mills.

WITNESS. About 72 per cent.

Q. How much do you exact from the mills?

A. We exact 65 per cent.

Q. And you mean to say that they have paid you 7 per cent. extra on all that was milled by the Union Mill and Mining Company?

A. I mean to say that, when we give the ore, they returned to us all they got out of it, and, in making out that return, it was 72 per cent. of the assayed value of the ore.

Q. You mean the whole average for the last year?

A. Yes, sir; what it figured up.

Q. Who made those assays?

A. The Chollar Potosi company, in their assay office, make them. They have an assay office of their own.

Q. And the management of the Chollar Potosi company and mill company are about one, are they not?

A. The same parties that manage the one do not manage the other. I am not a trustee. The trustees say no more to me in regard to the management of that mine than Mr. Sutro does.

Q. You have already stated that.

A. Yes, sir; and I state it again, and am ready to swear to it.

Q. Do you know who the owners of the Union Mill and Mining Company, and the trustees of the Chollar Potosi company are?

Mr. SUNDERLAND. I object again, and protest against any insinuations against gentlemen who are not here prepared to defend themselves.

Mr. SUTRO. I am not making any insinuations at all. The gentlemen of the committee will draw their own conclusions from this testimony.

The CHAIRMAN. Those are statements made to this committee.

Mr. SUNDERLAND. Yes, but it is all put on the record, and is reported with the testimony in this case, with all these insinuations. And I will remark here, that they are so far above Mr. Sutro that there is no comparison between them.

Mr. SUTRO. I do not see why Mr. Sunderland should exhibit so much feeling every time I touch upon the Bank of California, its mining ring out there, &c. The moment I ask a question where the Bank of California is concerned—where the profits are concerned—with regard to milling and mining, Mr. Sunderland objects every time; and that is the very thing we want to get at.

The WITNESS. I think that gentleman owns no more stock than you do in the Bank of California. They have not anything more to do with it, as a bank, than you have.

Q. I want to ask you who gets the tailings of these river mills that are left from the ore—who gets that 25 or 28 per cent., whatever it may be?

Mr. SUNDERLAND. I object to that as totally irrelevant.

Mr. SUTRO. Are they not mill perquisites?

Mr. SHOBER. We have heard something in regard to that.

Mr. SUNDERLAND. We have gone out of the record so far, and if this kind of evidence is to be received here, I being limited to four nights, I am afraid I will not get any thing in.

The CHAIRMAN. If an objection be made, of course we will entertain it. Is there any dispute about this question?

Mr. SUTRO. I do not think there is. It has been admitted by the commissioners, but here is a gentleman in charge of a mine.

The CHAIRMAN. If there is no dispute about it, why waste time in asking such questions?

Mr. SUTRO. Mr. Sunderland has stated and Professor Newcomb has stated that these tailings in the cañons have been floated down frequently. Are you aware of that fact?

A. Some years ago some of them were carried away; not recently, though.

Q. Don't you know that the whole reserves—that thousands and tens of thousands of tons—have been carried off by the flood?

WITNESS. How long since?

Mr. SUTRO. Within the last ten years.

A. No, I do not know any such thing.

Q. Did not Mr. Janin's carry off?

A. No, sir; whatever went out of that went down the reservoir of the river.

Q. Is it not a fact that it was carried off?

A. No, sir; not a fact that any very great amount was carried off, and that was saved in the reservoir below.

Q. And you mean to say that they have never lost any large amount of tailings in these floods?

A. I say of recent years they have not; there was considerable some years ago, because they did not then have a knowledge of the floods and the size of the river.

Q. Have you not seen the cañons flooded to such an extent that a horse could not cross for four or five days?

A. I have seen it. They might, at Dayton, have been prevented from getting across, but nowhere else in the vicinity of Devil's Gap. I went round there in about ten hours myself, after a big flood; but they do not occur these days.

Q. Will you please state why you came here? What made you come from California?

Mr. SUNDERLAND. I object. Is that an important question?

Mr. SUTRO. (It is) certainly a most important question. This gentleman has come here all the way from Nevada.

The WITNESS. I was told that the report that I had made to the commissioners had been disputed—alleged not to be true. I was telegraphed to that effect. I never like to have my veracity called in question, and I was asked if I would come on and substantiate it. I did very willingly, because I do not like to be charged, during my absence, with having told something that was not true.

Q. Did you know that you were?

A. I did not know. I was informed that the matter was called in dispute. A gentleman the other evening said that the testimony or the statements had been impeached. I thought at the time that I should like to have

corrected that. I have not seen any impeachment. They have been disputed, though, I believe. I think Mr. Sutro disputed them. The impeachment I have not seen, but I would infer from what the gentleman has said that they had been impeached.

Q. Who telegraphed to you?

A. It was said to have come from Mr. Stewart.

Q. Senator Stewart?

A. Yes, sir.

Q. Was Mr. Stewart's name signed to it?

A. That is the way it was stated to me.

Q. Did you get the telegram?

A. No, sir.

Q. Who got it?

A. I think the telegram was sent to Mr. Sharon.

Q. You did not see the telegram at all?

A. I saw it after it was translated.

Q. Mr. Sharon is an agent of the Bank of California?

A. Yes, sir.

Q. Did he send for you.

A. No, he asked me; he showed me the telegram, and asked me if I would go on.

Q. What did it state in the telegram?

Mr. SUNDERLAND. I object.

Mr. SUTRO. It has a direct bearing upon the question as to how this gentleman was called here.

Q. Who was that telegram signed by?

A. Signed by Leese and Waller.

Q. They are agents of the Bank of California at New York?

Mr. SUNDERLAND. I object.

The CHAIRMAN. If you know the fact that they are agents, state it.

A. I do not know that they are agents. They drew, I think, for exchange.

Q. What did you tell about Mr. Stewart sending that telegram?

A. I did not say he sent it.

Q. In what connection did you bring Mr. Stewart's name in here?

A. Well, I do not remember exactly, but I think that the question was asked me who the telegram came from, and I said it purported to come from Mr. Stewart.

Q. Now, you state it is from Leese and Waller?

A. You asked who signed it, and I said Leese and Waller.

Q. How did the dispatch happen to come from Mr. Stewart, if signed by Leese and Waller?

A. Very easily.

Q. Was not Mr. Stewart at Salt Lake at that time?

A. I do not know. I do not know where he was.

Q. How did you come to understand that Mr. Stewart had anything to do with this investigation?

A. I was told so.

Q. Who told you?

A. The party who received the telegram—Mr. Sharon.

Q. Did Mr. Sharon ask you to proceed to Washington at once?

Mr. SUNDERLAND. I object.

The CHAIRMAN. State if this gentleman requested you to come to Washington.

A. Not specially. He told me that my report was called into question—this meant the answers to the questions propounded by the commission—and if I deemed it necessary to go on, I had better do so. I desired very much to come, and I disliked very much to have my word doubted.

Mr. SUTRO. How long after that telegram came did you start?

A. Three or four days—four or five days—I do not know exactly the time.

Q. Did you go to San Francisco first?

A. No, sir.

Q. Who pays the expenses of your journey on here?

A. I am not aware as to who will pay them as yet. I have paid them myself, up to date, out of my own pocket.

Q. Do you expect to be reimbursed?

A. I will get some of the money back.

Q. From whom?

A. I expect the parties along the Comstock lode to divide the matter with me. Not the Union Mill and Mining Company by any means, but the entire lode. There are diverse interests there.

Q. Do you draw your salary while you are here?

A. That I cannot say. I have no understanding to that effect.

Q. Will you claim your salary during the time you are here?

A. I will tell you that when I get to that point.

Q. Did Mr. Sharon exhibit any feeling about this matter when he spoke to you, urging you to come right on?

Mr. SUNDERLAND. I object.

Mr. SUTRO. I think it is a very proper question to be asked.

The CHAIRMAN. I think you have gone far enough on that point. He stated that he requested him to come on, and asked him if he could come, and told him his report was called in question.

Q. Who did you report to, as superintendent of the mine, in San Francisco?

A. To the president of the company.

Q. To whom did you address your telegrams?

A. To the president of the company.

Q. Have you got any cipher with the president?

A. I have.

Q. Do you send all your telegrams in cipher about the condition of the mine?

A. That is written in a letter. There is a daily letter written.

Q. What did you have cipher communication with the president for?

A. That is my own business. I have business of my own with the president.

Q. Does not the president act for all the stockholders?

Is he not placed there as trustee to take care of their property and manage it for them?

A. Yes, sir; and I think he does it well, too.

Q. What was the object in having any secrecy about it?

A. I have some business myself, individually, with the president.

Q. Stock operations?

A. That is my individual affair.

Q. What did you telegraph about?

Mr. SUNDERLAND. I object. I do not know what all this has to do with the matter we are investigating.

Mr. KENDALL. I do not think that is proper.

WITNESS. I am not aware that I am a criminal here.

Mr. KENDALL. It has no bearing on the question at all, in my opinion.

Mr. SUTRO. It has a very great bearing on it. I want to arrive at the management of these mines. I want to ascertain whether there is any secrecy in the management of them, and whether the superintendent telegraphed the president secretly. This is very material. The business ought to be carried on for the benefit of all concerned.

Mr. KENDALL. That is a matter of argument.

Mr. SUNDERLAND. It is very proper, may be, for him to send his telegrams in cipher, so that the telegraph operators should not know what were the contents of the dispatches; but when they reached the place of their destination, the telegrams are deciphered and spread out on the counter.

Mr. SUTRO. What is the object of the secrecy?

WITNESS. That is a pretty broad question. Is it necessary to answer that, Mr. Chairman?

Mr. KENDALL. I think that would be a proper question.

By Mr. SUTRO:

You have a cipher—that implies secrecy?

Mr. SUNDERLAND. This is the object of the question: to show that no man on the Comstock lode, connected with the mine, who has a cipher with anybody in the world, can be an honest man.

Mr. KENDALL. We are now examining the witness. He has stated that he sent his telegrams in cipher. I think an obvious question that would follow would be, Why does he telegraph in cipher? That is a legitimate inquiry, as showing the motive. But when you ask what the contents of those cipher telegrams are, I do not think that is a legitimate source of inquiry. Of course, as Mr. Sunderland and every lawyer knows, cross-examination has a very wide circuit, especially with an unwilling witness.

The CHAIRMAN. Your object in telegraphing in cipher was to keep secret the operations of the company?

WITNESS. Yes, sir. We gave the office the first intimation in cipher. As a rule with those telegrams relating to the company, the ciphers were deciphered and the dispatches thrown upon the counter.

Mr. SUTRO. If they chose?

WITNESS. As a rule.

They concluded the cross-examination of the witness, and the committee adjourned to meet to-morrow. (Tuesday) evening, March 19, 1872, at 7 o'clock p. m.

HEARING TUESDAY, MARCH 19TH.

The committee met pursuant to adjournment. Present: The Chairman, Mr. Sessions, Mr. Kendall, and Mr. Shober.

The cross-examination of the witness, Mr. I. L. Requa, was resumed as follows, viz:

Mr. SUTRO. You have stated that the tunnel would be of no advantage to the Chollar Potosi mine, as regards ventilation and transportation. Do you mean to say that, if the Chollar Potosi mine, or rather the shaft, be connected with the lateral branch of the tunnel, it would not drain your mine?

A. There is nothing to drain.

Q. Is there no water in your shaft?

A. Well, I do not think that there is any water in our shaft. I have not sounded it for a long time, but I think the water all runs off in the Hale and Norcross.

Q. You say it is drained off into the Hale and Norcross?

A. That is my opinion. There was no water when we left the bottom of the shaft.

Q. How deep was your shaft?

A. 1,250 feet from the surface.

Q. Have you got any machinery on that shaft?

A. Yes, sir.

Q. How large is the engine on that shaft?

A. We have only one in use now; that is a hoisting engine. We had three: one pump engine, twenty inches, and two hoisting engines of eighteen inches. At the upper head, since the fire, when the works were destroyed, we have used only one hoisting engine of eighteen inches in diameter.

The CHAIRMAN. That is the cylinder?

A. Yes, sir; the cylinder.

Q. Mr. SUTRO. When was that fire at your works?

A. It took place two years ago last July. That is my recollection.

Q. You have never rebuilt your hoisting and pumping machinery there?

A. No, sir; never the pumping; have the hoisting.

Q. About that time you found the rich deposit?

A. No, sir; not at that time. We were prospecting in the upper works, and, in accordance with my suggestions to the company and trustees, rather determined to abandon deep working for the time being. There was nothing there to justify it.

Q. You had a good thing on top, at that time, I infer?

A. Not extraordinarily good at that time.

Q. It became so afterwards?

A. Yes, sir, afterwards. It was six months after that.

Q. Do you expect to prospect to any greater depth again?

A. I do not know what they may expect. I have not seen anything in the Chollar Potosi mine, at the lowest level, that would justify deeper prospecting than has been done.

Q. You have stated that there are hundreds of thousands of tons of low grades of ore in that mine?

A. Yes, sir, about three hundred thousand tons. That is about the estimate.

Q. Then you have stated that in three or four years all would be exhausted?

A. The question was asked and answered in your own way—at present rate of work.

Q. That was taking last years work out there, about eighty-five thousand tons, as the standard?

A. The question was asked at the present rate of work, and the answer was that I estimated that the three hundred thousand tons in three years would be about exhausted.

Q. Would you have to pay anything, if you took out no ore, under the contract between the Sutro Tunnel Company and the Chollar Potosi Mining Company?

WITNESS. What do you mean?

Q. If you took out no ore under the contract, would you have to pay anything?

A. I think not.

Q. Why, then, do you object to having that tunnel come in?

A. It is a point you and I differ upon. I say I do not object to running the tunnel; not for one moment. You may run a dozen of them, as far as I am concerned.

Q. You say you would not consider that of any benefit to the Chollar Potosi mine?

A. I say so, most emphatically.

Q. Would you state that it would not drain the water, if you connected with it?

A. In the first place, we have no water. That is stated in my report. The deeper we went, the dryer it became.

Q. You have just stated that it ran over into the Hale and Norcross mine.

A. I say whatever water that comes from the upper works, where we opened the earth, the ground has caved in and the snows gather, and that the water percolates and must find a way out; and that the small amount of water that is drained from there now goes through the shaft and earth, and does not accumulate. It may, but I doubt it. This is all surface water: I want you to understand that. This is my answer to these questions: that, so far as I have mined upon the Comstock lode, the water comes from the surface; and that is the history of every mine there.

Q. I did not suppose that anybody disputed that the water comes from the surface. It all comes from the rain and snow, does it not?

A. Yes, sir.

Q. Here is a contract executed upon parchment between the Sutro Tunnel Company and the Chollar Potosi Mining Company. You have stated that, when that tunnel goes in, it would cause litigation again, if the tunnel company should claim any body of ore to the eastward.

A. I do not think I made that statement.

Q. I think you did. Was it contemplated at the time

this contract was made that mill sites should be provided for this company at the mouth of the tunnel?

A. I have no recollection of that. You will bear in mind that, at the time that the contract was signed, I was not superintendent of the Chollar Potosi mine.

Q. In order to settle that point, I will read from the contract between the Sutro Tunnel Company, and the Chollar Potosi mine. It is article 20.

Mr. SUTRO then read as follows, viz:

"The parties of the first part further agree that they will sell to the party of the second part, the Chollar Potosi Mining Company, within three months thereafter, such parts of the land as hereinbefore provided. Any portion of a tract of land not exceeding ten acres, in a square body, situated within two miles of the mouth of the tunnel, to be designated by the parties of the first part, at some convenient and accessible point. The party of the second part hereby agree to pay therefor at the rate of five thousand dollars per acre, and the said party of the second part shall have the right of way through any lands belonging to the said tunnel company, and through the said tract of land which may be so conveyed. And the parties of the first part further agree to transport any ore belonging to the said party of the second part, from a point one thousand feet from the mouth of the tunnel to the land which may have been so purchased by the said party of the second part, at the rate of twenty-five cents per mile for every ton so transported."

Q. Will you please look at that—article 20.

A. Well, sir, that is the signature of the president and secretary of the company, I guess, without any doubt.

Q. Do you see the seal of the company on there?

A. Yes, sir.

Q. It is properly acknowledged by the notary, &c.?

A. Yes, sir.

Q. Will you please read that acknowledgment?

The CHAIRMAN. I see no necessity for that. It is admitted to be duly executed.

Mr. SUTRO. Yes, I do not see myself any necessity for it.

Q. You have spoken of Mr. Carlyle, and have stated that he was a pretty good figurer, but that he was very impracticable?

A. Yes, sir.

Q. You say that he has put an engine under ground. At whose instance was that put there?

A. I think it was his suggestion.

Q. Was not Mr. Strong superintendent at that time?

A. Yes, sir.

Q. Was he not the chief?

A. He was chief, but Mr. Carlyle made the suggestions as to everything that should be done.

Q. Do you mean to say that it *would* be done?

A. No, sir; I do not mean to say so, simply because they did it.

Q. You rather depreciated Mr. Carlyle in your testimony here. Are you aware that Mr. Carlyle is a very superior mechanic?

A. I say theoretically that Mr. Carlyle is a very good mechanic, as far as I know. Practically, he is an experimenter, and rather an expensive one at that.

Q. Nothing more than that?

A. I do not mean to detract anything from Mr. Carlyle's ability.

Q. Do you know that the Gould and Curry mill was built entirely under the superintendence of Mr. Strong—under his direction?

A. Yes, sir.

Q. If any mistakes were made, to whom would they have been attributed?

A. Mr. Carlyle made the figures for the practical and successful working of it. He got up the engine, and spent his time in superintending and getting them all up. Everything was gotten up according the plans and specifications of Mr. Carlyle.

Q. Had he any knowledge of the kind of amalgamating process that was to be used there?

A. The presumption is that he ought to have known.

Q. It was a new idea, was it not?

A. No, sir, not entirely new. Other operations of that kind had been started in other sections of the globe.

Q. You stated that there was no want of capital. How do they raise money when the mine runs behind?

A. They usually pay their debts by assessments.

Q. Make the stockholders come up?

A. That's right.

Q. Or sell them out?

A. That is according to law. They do nothing except what is according to law. If they do, they are generally made to suffer for it.

Q. That is the way they raise their money?

A. That is the way they raise their money—by assessments—and it is a very fair way, too.

Q. You say you did not hear of a certain man named, _____; who built a mill there?

A. No, sir.

Q. Would it be anything extraordinary if you did not know of every man connected with a mill company?

A. It would be somewhat extraordinary, because I have been there a long time, and know about every mill in the country.

Q. About every mill man, too?

A. I am pretty well posted. I claim to be, at least.

Q. You think you know all that is going on?

A. I do not know that I know all that is going on. That is more than I claim. I am speaking about the mills. I have taken some interest in them, as far as working them is concerned, and the men that manage them.

Q. How deep is the Chollar Potosi mine shaft?

A. Twelve hundred and fifty feet in a vertical line.

Q. How far would it have to be extended to reach the tunnel level?

A. I would have to refer to that book, I guess. I do not know exactly now. What is the depth of the Sutro tunnel at the point marked "A"?

Mr. SUTRO. About 1,900 feet.

WITNESS. It would be 1,470 feet from the point marked "A," and the difference between 1,470 and 1,900 is where the Sutro tunnel level would come—430 feet.

Q. In your report here you say that it costs about \$45 per foot to sink a shaft?

A. To sink an incline.

Q. How much would it cost to sink 430 feet at \$35 per foot?

A. It would be about \$15,000, would it not?

Q. How much money did you—your company—take out last year?

A. For the company's year, three million four hundred and sixty-nine thousand six hundred and forty-nine dollars and thirty-five cents, (\$3,469,649.35.)

Q. You must have had very little curiosity to find out what is below there not to spend \$15,000 to get down to the tunnel level?

A. Well, sir, I do not think it is a matter of curiosity. It is simply a matter of judgment.

Q. You never expect to go down there?

A. Well, sir, I never expect to, I think, because the indications were decidedly against any ore making in that section of the country.

Q. Then you will not oppose the Sutro tunnel at all?

A. Not by any means. If Mr. Sutro takes his money and contracts to construct the tunnel without Government aid, and runs it in that way, I will not oppose him, but am rather disposed to give him a helping hand.

Q. Then you are rather a patriotic gentleman, and are desirous of taking care of the interests of the country?

A. I do not know whether I am a patriotic gentleman or not. I am desirous, however, of seeing everything done that is proper.

Q. You came all the way from Nevada at your own expense to protect the interests of the Government?

A. I think, sir, I would do that if I could, at any rate.

Q. You are a pretty good citizen?

A. I claim to be just that citizen—a full-blooded, native-born American.

By Mr. SUNDERLAND:

Q. Did you find anywhere in Mr. King's report any corroborating testimony of your own experience, that the walls of the ledge gave out at 1,250 feet level in the Chollar mine?

A. Yes, sir.

Q. Mr. Raymond has made several reports upon the mines, and among others upon the Comstock lode. I will ask you to state if Mr. Raymond was ever upon the Comstock lode?

A. I do not know.

Q. Mr. Raymond states in his last reports that there are forty companies operating on the Comstock. I will ask you to state if this is correct or not?

A. There is not that number.

Q. What is the number?

A. I can count them on my fingers. On the north, there is the Sierra Nevada, the Ophir, and the Consolidated. How many are in operation now, do you mean?

Mr. SUNDERLAND. Yes, sir.

WITNESS. Gould and Curry, Savage, Hale and Norcross, Chollar Potosi, Bullion, Imperial, Empire, Gold Hill, Consolidated, Crown Point, Belcher, Overman, Caledonia, and the Kentuck. Those are all, I believe. That makes about sixteen, as I counted them. King's "Mining Industry," Volume 3, page 60, figure 2, atlas plate 12, shows the aspect chamber on the present level. In the Chollar Potosi mine the vein is entirely wanting, the walls of the propylite and syenite being simply parted by an almost imperceptible sheet of clay.

Q. There is another question. What is the proportionate value of the gold to the silver and bullion yielded by the Comstock lode?

A. The value is over one-half gold.

By Mr. SUTRO:

Q. Please look at this list of mining claims, given in King's report, page 99, and count how many there are.

A. The question asked me was, how many were in operation.

Q. Please count how many mines are given there.

A. They would make, according to that, about 46.

Mr. RICE. That is King, is it?

A. Yes, sir.

Q. You say 16 only were worked?

A. Yes, sir.

Q. The balance had to give up, I suppose you mean to say?

A. Some of the mines are worked out. For instance, the Bacon mine is totally exhausted. The Eclipse mine, the Plato mine, and others.

Q. That is your own opinion about it, is it not? You have never seen any mines except those on the Comstock, have you?

A. I have no opinion about it. They have deserted them, in consequence of their not paying. They say they are worked out. There are others in a similar fix.

General C. C. Batterman sworn.

Examined by Mr. SUNDERLAND:

Q. How long have you been engaged in mining?

A. About thirteen years altogether.

Q. Where have you been engaged in mining?

A. In California and Nevada.

Q. How long have you been engaged in mining upon the Comstock lode?

A. I went there in 1865.

Q. What position or positions have you occupied upon the Comstock mine?

A. Superintendent of the Crown Point and of the Gould and Curry.

Q. Have you had any experience in milling?

A. Some.

Q. Now, I will ask you if you know Mr. George Atwood?

A. Yes, sir.

Q. While you were superintendent of the Crown Point mine, was Mr. Atwood connected with that mine in any manner?

A. No, sir.

Q. Did he have any contract with the company? If so, state what that contract was.

A. He had a contract with the company to take out the low grades of ore above the 160-foot level, I believe, up to the surface.

Q. How long did he work under that contract?

A. My impression now is about four or five months. I would not be positive about that. It was only a little while. It may have been six months.

Q. What did he agree to pay the company for the ore he took out.

A. As to that I am not positive. I have forgotten the amount he was to pay, but it was a very small sum. My impression is that it was \$1 per ton.

Q. Was there any failure on the part of the company or Mr. Atwood to comply with that contract?

A. Mr. Atwood tried it awhile, and then abandoned it. He could not make it pay.

Q. Do you know Mr. Carlyle?

A. No, sir.

Q. You had no personal acquaintance with him?

A. No, sir.

Q. Did you know anything about his operations with the Gould and Curry company?

A. He has a general reputation of making a botch of the Gould and Curry mill, and a failure of it.

Q. You know something about that Gould and Curry mill, do you not?

A. Yes, sir.

Q. What were the results of running that mill by the company?

A. Debt.

Q. Do you know about what it cost?

A. Simply from the statements. I have been told about \$800,000 dollars.

Q. Do you know how far the power or engine was from the batteries?

A. Not exactly, but it was a very long distance; 100 feet or over, I should judge.

Q. How far were the pans and settlers from the power that run them?

A. The main driving shaft for the pans was about 30 feet.

Q. How far from the engine were the pans?

A. That is what I mean. The driving shaft was about 30 feet from the engine.

Q. I will ask you whether that mill had to be abandoned, and, if so, why?

Q. It was abandoned because it could not be made to work economically. They could have the ore crushed cheaper than the mill could work it.

Q. I will ask you now, without going into the items, whether the facts stated in your report to the Sutro tunnel commissioners are true? Did you take from your books the expense of pumping, drifting, and sinking?

A. Yes, sir. Of all but one drift, I believe. One drift was run by contract. I took it at the contract price.

Q. You are well acquainted with the Carson river, are you not?

A. Yes, sir.

Q. What do you say of the conformation on either side of the river, with respect to its holding water under a pressure of 150 feet?

A. I should think it would be a very difficult matter for it to hold water. The rocks have been very much disturbed by upheavals, set up on edge, and very much broken.

Q. What is the quality of the soil on the north side of the river, above the hills, where the water by this dam would overflow the country above the Morgan mill?

A. It is very dry—dry sand.

Q. Is it not debris washed down from the mountains—decomposed granite, is it not?

A. Yes, sir.

Q. Does or does not the water percolate freely through that soil?

A. Yes, sir, it does.

Q. With that material to raise embankments, would it

be possible to prevent the water from running through it as through a sieve?

A. In my opinion, it would not.

Q. I will then ask you whether, in your opinion, the rocks of this soil would hold water at a pressure of 155 feet, as it is proposed to raise this dam at the Franklin dam?

A. Very doubtful, in my opinion, whether they would.

Q. If a dam is erected for the purpose of a reservoir, where do you take the water from?

A. From the bottom.

Q. Then, taking the fall in the river, as stated by General Day in his report, what would be the fall acquired in the Carson river, taking the water to a point opposite the mouth of the Sutro tunnel?

WITNESS. Taking it in the flume?

MR. SUNDERLAND. In the flume, ditch, or anything.

WITNESS. About 94 feet; that is, assuming the distance from the dam to the point of discharge at six miles.

Q. Supposing the fall in the river, as stated by General Day, should be 100 feet from the dam to a point opposite the mouth of the Sutro tunnel, would not the fall, for the use of milling power, be much less than the fall on the river on account of the height of the banks?

A. I think it would.

Q. Would it not be less—the available fall be less than 94 feet, as you have stated?

A. What I mean is, that the point of discharge at the end of the flume would be about 94 feet above the bed of the river—above the surface of the water, as it now runs.

Q. How far, then, is the surface of the water in the river at that point below the embankment, where mills could be erected?

WITNESS. Right opposite the tunnel?

MR. SUNDERLAND. Yes, sir.

A. Well, I could hardly say; not very much. Probably somewhere from 3 to 6 feet. I cannot be definite about that.

Q. I will ask you, in your opinion, taking this fall of 94

feet, or whatever the fall is from the dam to a point opposite the mouth of the tunnel, how many tons of ore could be reduced by the water in the Carson river?

A. That would depend somewhat upon how many mills you could get in there between the mouth of the ditch and the river.

Q. How much power would there be of that fall from 90-odd feet?

A. It could not work more than 600 tons; that is, with the present mode of working.

By the CHAIRMAN:

Q. For what length of time?

A. For a day.

Q. Do you know about the capacity of the present mills upon the Carson?

A. Not exactly, but in the neighborhood of 1,000 or 1,200 tons.

Q. Then the power at the point of the mouth of the tunnel would be much less than the present power as used on the Carson river?

A. Yes, sir.

Q. If additional power were required at the mouth of the tunnel to compress air for use in the Comstock, and also for running the machinery for concentration of ores, would that still detract from the quantity of ore worked at the mouth of the tunnel?

A. Yes, sir; the water could not be used for both purposes.

Q. Do you know anything about the healthfulness of this Carson valley?

A. It is not very healthy in the summer. There are ague, fever, and chills there.

Q. What would be the effect upon the health of the neighbors of a river, if a reservoir of the size of that contemplated—1,480 acres—should be made?

A. I should think it would be unfavorable; that is, in that climate.

Q. Have you an opinion as to what effect that would have upon the citizens of Carson City?

A. Well, I don't know as it would make much difference there as to the health.

Q. Would not the water back up on the city there?

A. If the water was allowed to back up over the flats it would.

Q. Would or would not the water of this reservoir overflow all the mill property above the dam now on the river?

A. I think it would.

Q. Would it not overflow Empire City?

A. Yes, sir.

Q. How many people live in Empire City?

A. About four hundred.

Q. Do you think it possible, with the soil at Empire City, to throw up an embankment there that would prevent water from seeping through and overflowing the town?

A. Not with the soil alone. I do not think you could.

Q. Then you think that the reservoir, as contemplated in the report of the commissioners, would destroy Empire City, do you not?

A. Yes, sir.

Q. Do you know what length of the railroad would be overflowed by that reservoir?

A. Between two and three miles.

Q. I will get you to state now, on the north side of the present track of the railroad what kind of a hill there is, and give your opinion as to whether the road could be raised above the water?

A. It could be raised, but it would be a very expensive job.

Q. What is the incline of that hill—what degree of incline on the surface?

A. I should think it was between 40 and 50°, a good part of the way. Of course I could not say positively as to that.

Q. What is the conformation there, where this hill is so steep?

A. Rocky.

Q. What would be the effect of the business upon the railroad, if the tunnel was completed and the ores reduced at the mouth of the tunnel?

A. Well, it would reduce it very much; make it pretty near worthless.

Q. What is the sentiment amongst the property owners of Gold Hill and Virginia City as to the construction of this tunnel?

A. I think they are opposed to it.

Q. How are the merchants and mechanics and traders generally?

A. Opposed to it.

Q. I will ask you what the sentiment is now amongst all the tax-payers of those two towns?

A. There may be some who probably favor it, but the great majority of the tax-payers are opposed to it.

By the CHAIRMAN:

Q. What is the population of those two places?

A. About 12,000—they are one place really—somewhere between 10,000 and 12,000.

Q. What will be the effect of taking the business away from the railroad upon Carson City?

A. To use a Nevada expression, it would "burst it."

Q. What is the population of that town?

A. My impression is it is about 12,000, but I am not positive.

Q. That is the capital of the State, is it not?

A. Yes, sir.

By the CHAIRMAN:

Q. Is that up this valley, Carson river?

A. Yes, sir.

Q. What is the distance from the mouth of the tunnel to Carson City?

A. About 14 miles.

Q. And the railroad runs up to Carson City?

A. Yes, sir.

Q. State, if you know, what the cost of milling upon Carson river is—the cost to the mills?

A. No, sir; I do not know.

Q. Do you know what per centage of the gold and silver in the ores of the Comstock is saved by the present mode of working it, including the return to the mining company by the mill, and all that is saved from the slimes and tailings being worked?

A. About 90 per cent—from 90 to 92 per cent.

Q. Has there been for four or five years any loss of tailings by flood, or otherwise?

A. No, sir.

Q. What preparation is made there for the saving of the slime and tailing?

A. A series of reservoirs.

Q. And what escapes from one is caught in another?

A. Yes, sir.

Q. Do you know what the assayed value of the slimes and tailings is, when they are caught at what is known as the Woodworth mill, on the Carson river?

A. I do not.

Q. Do you know any means of working slimes, so as to save the metals, without drying them?

A. No.

Q. Has it been tried?

A. Yes, sir; I tried myself about a year.

Q. I will ask you if everybody there tried it?

A. A great many persons.

Q. Was it or not a failure?

A. A perfect failure.

Q. Have you ever been at this tunnel since it was commenced?

A. Yes, sir; shortly after it was commenced, but I could not say how long.

Q. About what time was it commenced?

A. I could not say positively. I kept no run of the time. It might have been three years ago, but I cannot

say positively. I was there about the time Dr. Hazlett took charge of it.

Q. Mr. Sutro has said a great deal before this committee about the expense of having machinery, to be placed upon these shafts on the line of the tunnel, and has introduced telegrams in reference to them. Have you seen any of that machinery?

A. I have seen some on the road.

Q. What kind of machinery was it?

A. I saw some heavy machinery there, I think, sir. The machinery that is at present in operation on the tunnel is what we call "donkey engines."

Q. Explain to the committee what you mean by donkey engines?

A. A little engine and boiler connected, such as is used on the wharves here for hoisting freight out of a vessel.

Q. Did you see any pumps in transit?

A. I saw one on a team said to be going there.

Q. What kind of a pump was it?

A. One of those little Stoddard pumps.

Q. Was it a force pump?

A. Yes, sir; they are force pumps; we call them plungers.

Q. Stoddard pumps—what do you use them for?

A. We put them in wells—pump where there is not a great deal of water. We do not use them in the mines at all—not in Nevada.

Q. Do you know what was charged for milling ores when you first went upon the Comstock?

A. \$18 per ton.

Q. What is the present price?

A. The last we had milled we paid \$12 for.

Q. Do you know of any ores being milled for less than that?

A. No, sir, not positively, that ores have been milled for less than that. I do not know whether they are now or not. Ores have been milled for \$9 and some for \$8.

Q. That is the cost of the milling?

A. Yes, sir.

Q. What has been the effect of the railroad upon the cost of supplies for the mines?

A. Reduced it very materially.

Q. Is the cost of mining now at a great depth more or less than it was six or eight years ago, when you knew the Comstock at a point 200 feet below the surface.

A. Less, sir.

Q. Do you know anything about the cost of the removal of mills? Have you had any experience of that kind?

A. No, sir; I never removed any.

Q. Would it take one or two removals to be equal to a fire?

A. Two certainly would. I think one would.

Q. What is there in the mills now that could be used in the construction of new mills at the mouth of the tunnel?

WITNESS. I said awhile ago that I never removed a mill; had no experience of that kind. I will state that I did remove the amalgamating machinery from a mill at Dayton; that is, I removed the pans and the frames. I moved it to the De Lande mill in the Seven Mile cañon. It cost a great deal more than it would to have gone to work and bought the pans and set them up.

Q. Then you had an old mill when you had it built?

A. Yes, sir.

Q. Of what use would the engines and boilers in the steam mills be, if the other machinery in those mills should be removed to the mouth of the tunnel?

A. Be of no use there. You might use some of the boilers to generate steam to heat the pans with, but that is all.

Q. Did the Sutro tunnel commissioners ever ask you to make an argument against the construction of the Sutro tunnel?

A. No, sir. The only request ever made of me was from the printed form of questions, except such questions as they asked me when visiting the mines.

Q. I will ask you whether the completion of the tunnel

would be of any advantage to your mine in drainage or ventilation, or in any respect; and, if so, what advantage it would be?

A. It would be of no advantage in ventilation. I do not think it would be any in drainage.

Q. How many hours a day do you run your pumping engine?

A. We run the upper pumps about sixteen hours per day now. The lower pumps we run about five or six hours a week.

Q. What is the condition in reference to the water at the bottom of the shaft?

A. We started an incline. The shaft is down. There is no water in it at all, except such as leaks over from the tank above.

Q. What is the deepest level at which you have found any water in the Gould and Curry?

A. I think 800 feet.

Q. Do you know anything about the Savage, as to the water in that in the lower level?

A. They have none. They did not when I left there.

Q. Has there been any more water in the lower levels of the mines this winter, being a wet winter, than there has been for the last year?

A. No, sir.

Q. Does the water in the Comstock increase or decrease as you go down?

A. It decreases.

Q. I would like to have you explain to the committee why it is that the tunnel could not ventilate the different mines of the Comstock?

A. The air would simply pass through the mine in the most direct way to the shaft; that is, it would pass up through the tunnel connecting the shaft, wherever it was. On either side of that line it would have no effect whatever. The air would have to be placed there by artificial means.

Q. How far from the current of air passing from one

shaft to another, or from the tunnel to a shaft, would the atmosphere be affected in a drift at right angles say with the tunnel?

A. A very few feet. Perhaps 15 or 20.

Q. In prospecting drifts on the Comstock and in the stopes after you discover ore, is it possible to get fresh air, except by artificial means?

A. No, sir.

Q. I will get you to state if you know any place on the Comstock, where different shafts are connected, where the air is so strong that you cannot burn a candle?

A. Oh, yes, sir. One in the Yellow Jacket, between the Yellow Jacket and Crown Point, and between the Savage and Hale and Norcross.

Mr. RICE. You mean the circulation of air?

Mr. SUNDERLAND. This current passing from one point to another. Where you find that current of air between two shafts, is there any ventilation outside of the mere drifts between the two?

A. No, sir.

Q. What means are then necessary to be used to get fresh air in the prospecting drifts, the headings, and stopes?

A. We pump it in—force it in.

Cross-examination by Mr. Sutro.

Q. How long have you been superintendent of the Gould and Curry mine?

A. About two years, I think, now.

Q. When you were appointed superintendent of that mine, did you have any consultation with Mr. Sharon in regard to it?

A. No, sir. I did with Mr. Sharon and other parties—Mr. Sharon and Mr. Hayward.

Q. Mr. Sharon consented that you should become superintendent?

A. No, sir; he did not consent to anything of the kind.

Q. Who placed you there?

A. The board of trustees.

Q. At whose particular instance were you placed there?

A. That is more than I can tell you. They asked me to come there officially.

Q. Did you have any consultation with Mr. Sharon in regard to it?

A. No, sir; not previous to the appointment, any more than he sent me a note and asked if I would accept the position?

Q. And you consented?

A. Yes, sir.

Q. Will you please state who the trustees of the Gould and Curry mine are at present?

A. I hardly know.

Q. Here is your report. Please read them from that report.

A. Messrs. Bull, Weller, Harmon, Norris, Fry, Sherwood, and Morrow.

Q. Who is treasurer?

A. I do not know, unless it states there. I have no knowledge of my own.

Q. Have you ever heard?

A. I do not know that I ever have. I could not say.

Q. I have asked you if you ever heard who the treasurer of your company is?

A. I do not know that I ever did.

Q. You do not know?

A. No, sir.

Q. The treasurer keeps the money of the company?

A. I presume so, whenever they have any money.

Q. You do not know who the treasurer is?

A. If it states there—I have never been told who the treasurer was.

Q. Do you not know it is the Bank of California?

A. I do not know that it is the Bank of California.

Q. Do you know who Mr. Fry is—one of your trustees—whether he is any connection of Ralston, cashier of the Bank of California?

A. I do not know.

Q. Do you not know who Mr. Norris is, and whether he is a director of the Bank of California?

A. I do not know. Only Mr. Norris was a steamboat man some years ago: that is the only knowledge I have.

Q. You do not know whether Mr. Bull had any connection with the Bank of California?

A. I do not.

Q. How did you happen to come here?

Q. I came on the railroad.

Q. What made you come?

A. I was requested to come. I was asked if I would come.

Q. Who asked you?

A. Mr. Sharon.

Mr. SUTRO. That is all.

Adjourned to meet on Friday evening, March 22, at 7 p. m.

HEARING FRIDAY, MARCH 22D.

F. T. LALLY, called and examined.

By Mr. SUNDERLAND :

Q. Have you been educated, and have you had any practical experience as an engineer?

A. Yes, sir.

Q. In what part of the country have you been engaged in engineering, if in any? State what part or parts, and what kind of engineering?

A. In Maine, New Hampshire, Massachusetts, Vermont, Georgia, Alabama, Florida, Arizona, and Illinois. It would be very hard for me to say where I have not been an engineer in my former days.

Q. Have you had any experience in the erection or building of dams on water courses?

A. A good deal of experience, in my younger days, on rivers in the East—on the Kennebec, the Androscoggin, and other streams there.

Q. What is the highest dam that you know anything about, either having seen it or read about it?

A. The highest dam that I have seen, I think, is at Lewiston, Maine. It was about 32 feet. What I have read about is a dam on the Pyrenees, about 39 metres. That is the highest one I ever heard of.

Q. Of what is that dam constructed?

A. It is composed of masonry, reinforced on both sides with rock and other material.

Q. Do you think it possible to make a dam 155 feet of any material to stand, unless it is made of masonry?

A. Not to hold water.

Q. Have you been in the Territory, now State, of Nevada?

A. Yes, sir; I visited the country, for the purpose of observation, in 1861.

Q. Having seen the country there, the rocky formation

there, and the soil, or rather gravel and sand, what is your opinion as to its holding water with a pressure of 155 feet in the Carson river?

A. Well, my opinion is that it won't hold it.

Q. Why not?

A. Because, where you find it rocky, it is seamy; and even when the seams do not appear, with any considerable pressure of water the water goes through. This I infer from my own experience further south in Arizona.

Q. State that experience?

A. Then I found that, in making a reservoir for water, everything seemed to be perfectly sound in the rock.

Q. It stood blasting?

A. I made a reservoir of 15 feet, I think, to hold my water that I took out of the shaft, and it went through it like a seive, and I had to——indeed the only remedy I had was to cement it.

Q. You saw this conformation on or near the Carson river when you were there, did you not?

A. Yes, sir.

Q. How would the rock there compare with that in Arizona, where you had this practical experience?

A. It seemed to me to be very much of the same formation.

Q. Now, I will ask you whether pine wood—and I believe that is the only kind of wood found on the eastern slope of the Sierra Nevadas—would hold water with that pressure?

WITNESS. 155 feet?

COUNSEL. Yes, sir.

WITNESS. No, sir.

Q. Have you ever observed or had any experience with wood holding water? If so, state what.

A. I have tried to use wood, with about 70 feet head—logs about a foot thick, white pine 2½-inch bore. When the water was put on, it went through in a perfect mist.

A. About what will be the pressure per square foot on

the bottom of a basin, if the dam should be filled—the reservoir filled to the height of 155 feet?

A. It would be 155 feet by 62.

Q. If that is your calculation, just give the pressure per square foot?

A. Well, the pressure per foot on the bottom of such a basin would be 160 by 62—9,920 pounds. No wood used in the arts could hold water under such a pressure.

Mr. SUTRO. How many pounds?

A. One hundred feet, I call it, by 62 pounds—9,920 pounds.

Q. If you have arrived at any conclusion, what is the comparative evaporation in the Carson valley with other countries—the coast—the Atlantic coast?

A. I cannot help thinking that the evaporation is much greater there than it is on our rainy coast here. We have never had any observations that have come to my knowledge to determine that.

Q. What reason or reasons have you for thinking so?

A. There is a long season without rain. It is an exceedingly arid country, and everything seems to be thirsty for water. We have no dews. Now I am speaking of a country south of that.

Q. Just confine yourself to the Carson valley; you spent some little time there.

A. I spent some little time there. There was no dew when I was there; it was in the summer season.

Q. Is there any wind there?

A. Plenty of it, and very strong.

Q. How is the heat of the sun?

A. Very hot—parching.

Q. Do you think it possible, after a dam is erected to the height spoken of, that it could ever be filled with water?

A. My impression is, from conversation and observation, that no such basin could be filled in that region.

Q. On the account of what?

A. The filtration and evaporation; particularly filtration.

Q. What kind of a dam would it be necessary to build there to hold water—the dam itself—in your opinion?

A. I think a dam of masonry would be most economical, and be the best dam, and the only dam that would hold water.

Q. To build a dam of that kind, it would be necessary to go down far enough to reach solid rock, would it not?

A. Yes, sir; very solid rock—have to go down below the bed to very firm rock.

Q. About what would be the expense of building a dam of that kind, taking into consideration the cost of supplies there and the cost of labor?

A. I have not been able to make up my mind what it would cost. It would certainly cost over \$1,000,000.

Q. If you had the dam erected and the reservoir full, how would you drain the water off from the dam?

WITNESS. For use?

COUNSEL. For use.

A. Well, take it off by a flume.

Q. Well, from the upper to the lower side or end of the dam. What kind of a conduit would it be necessary to construct, suppose you build a dam of timbers or rubble, or anything else?

A. I do not allude to dam of timbers, because timbers won't hold water under that pressure. At the bottom we should have to have a flume built of masonry.

Q. If it were possible to put in a dam or loose stone, how could you conduct water through that dam, so as to take it from the head of a flume or race below the dam?

A. We would have to make it of masonry—very firm.

Q. Under that pressure of water, would it be possible to have a gate, that you could raise or lower, so as to let off the water?

A. I suppose it would be possible, but very difficult, at the bottom of the dam.

Q. What kind of machinery could you construct to make a gate stand there; or, if it stood, to raise and lower it?

A. Machinery might be constructed to meet the object;

that would not raise the gate perpendicularly, but would raise it on an angle with machinery.

Q. Then how would you close it?

A. By the same power that raised it. I cannot conceive of an opening of that kind. It is a matter that I do not know anything about practically, nor do I suppose any body else does.

Q. Do you think it practicable as a business proposition to build the dam at all?

A. No, I do not. I think it would cost more than it is worth.

Cross-examined by Mr. Sutro.

Q. You state you have been an engineer. Have you been engaged in engineering works of late?

A. Not lately.

Q. How long since?

A. About eighteen years ago, except as a miner. As a civil engineer I have not been engaged in any works for eighteen years.

Q. You say you have built dams in the eastern States. What is the character of the country where you built those dams? Was it a mountainous country?

A. Not particularly, where the dams are built.

Q. You say the highest dam that you know of, or that you have seen, is in Lewiston, Maine. You have read about a dam in the Pyrenees 39 metres high: How many feet is that? That is 39 by 39 inches—112 feet?

A. Yes, sir.

Q. Do you know of any dam in the United States higher than the one at Lewiston?

A. No, sir, not of my own knowledge; but I know there is a dam of 71 feet on the Croton, to the best of my belief.

Q. You have said here, it is impossible to build a dam 155 feet high that will hold water?

A. No, I have not.

Q. I so understood you?

A. I said that I did not think a dam 150 feet high there would fill the basin.

Q. You say you have been in Nevada: How long did you stay in Nevada?

A. About two months. I went there for observation—to see the country.

Q. Did you pass along Carson river, between Carson City and the town of Dayton—did you follow the river?

A. I did not follow the river particularly.

Q. Did you follow the river at all, or was it possible for you to follow the river?

A. No, sir; I do not think I did. I was up there several times and in several places.

Q. Do you know anything about the rock formation there?

A. Nothing more than general observation of the rock of Virginia, and as you go on the road up.

Q. Do you know that there is a difference in the rocks as far as the absorption of water is concerned?

A. Yes, sir, a vast difference in the character of rock about there.

Q. There are some kinds of rock that will not allow water to permeate them at all?

A. Permeate very little.

Q. Do you know what kind of rock there is at that particular point where this dam is proposed to be made?

A. I suppose it was a perforated rock, like the rock on the whole basin all the way down through the country. No, sir; it is not perforated rock at that point, it is a trachyte.

Q. Have you seen the trachyte anywhere in your own experience?

A. Yes, sir.

Q. In what parts of the country?

A. I have seen it in that part of the country.

Q. At what particular point. Will you name the point where you have seen trachyte rock in Nevada?

A. Not in Nevada. I have seen it in Arizona.

Q. At what point?

A. Colorado, fifty-four miles south of Tucson.

Q. Do you know what that is composed of?

A. Not particularly. The geologists and mining engineers spoke of the rock as being there, and I took it for granted that that was the rock.

Q. Do you know that trachyte is a rock that, when it has once been penetrated by the water, will not allow a drop of water to go through it?

A. No, I did not.

Q. That it is one of the closest rocks we know of; that it is a volcanic rock, no seams in it; and when there are any signs of seams, it is very close indeed. Do you know that?

A. That may be so.

Q. You did not visit that particular point where we propose to build that dam?

A. No, sir.

Q. Are you aware that there is a belt of trachyte which comes through there about two miles in width and 15 miles in length, that crosses the river at that point?

A. I do not know anything about it.

Q. Suppose you would find that rock: then you would change your opinion somewhat, would you not?

A. No; but the difficulty is, that this water is thrown back on 1,400 acres of ground. It is not the face of the rock we have passed at the gorge.

Q. You say you have not been at the gorge, and you do not know what the formations there are?

A. I simply heard the description of these commissioners.

Q. They have given no description whatever of the rock on Carson river—not referred to it even?

The WITNESS. This seems to be a conversation. I will say I know nothing further than that this dam would cover say 1,400 acres, and my impression, as I stated that impression in the first instance, is, that you would hardly find 1,400 acres there that would hold water.

Q. Who told you that?

A. The report; 1,400 it is stated.

Q. Where is that stated in the report?

A. In General Day's report.

Mr. SUTRO. Oh, General Day's statement. Then you say you have never been down there, and you do not know anything of the formation of the rock along the river of your own knowledge?

A. Not particularly.

Q. How can you form any idea that the rock would not hold water?

A. Simply in the principle that none of these rocks will hold water on that coast; that is, between that low belt of country.

Q. Are you aware that there are, within four miles of where our tunnel goes, three or four distinct formations of rock of different geologic ages, entirely different and distinct?

A. I see that from the reports; and yet I believe all those rocks are permeated by water.

Q. Do you mean to say that trachyte rock is easily permeated by water?

A. No; I do not mean to say so. I do not know of any special formations anywhere of that rock.

Q. You do not know that there is any?

A. No; not to a large extent there, judging from the reports and books I have read.

Q. Do you know that there is a species of volcanic tufa along that whole bed—along that range—that forms a clay that is almost water-tight?

A. I know we find a clay almost everywhere in streams and in connection with our lodes.

Q. How long did you stay in that section of Nevada, where this dam is proposed to be built?

A. I stayed no time of any consequence at all. I do not know exactly where your dam is proposed to be built.

Q. How can you state, then, the rock won't hold water, when you do not know where the dam is to be built?

A. I stated on general principles that none of that rock will hold water.

Q. You do not know what kind of rock there is?

A. No, sir; I do not know what the rock is there at that particular place.

Q. You say that a dam constructed out of pine wood would not hold water there; that it would go through it like a mist. Was that your statement?

A. Yes, sir.

Q. Do you know whether anybody proposes to build a wooden dam there?

A. No, I do not know; but I think General Wright suggested that it was the intention to build such a dam.

Q. When did you see General Wright?

A. Oh, I saw him some time since.

Q. He told you they were going to build a wooden dam?

A. Face it with wood or something of that kind.

Q. Suppose you build a very strong stone dam, and build up your stone like mason work and face that with wood: would that hold water?

A. The masonry would hold water; the wood would not.

Q. Would it assist any if it was lined with wood on the inside. Suppose that wood be put in reasonably day, then the water will run on to it, will it not, and make it pretty tight?

The WITNESS. 155 feet?

Mr. SUTRO. Provided there was a dam of 500 feet at the base, made of stone work?

A. At the base of 155 head it would be penetrated with water.

Q. Suppose it was put right across the stone dam—solid stone work.

A. That would not affect it.

Q. Then that would be water-tight?

A. It would be pretty tight; the masonry would save it.

Q. You have stated that the evaporation in Carson valley is very great, and that they have no rain there?

A. I stated my opinion was, that it would be otherwise greater than it would be on the coast.

Q. What has that got to do with the evaporation? If you have a lake or basin that is full, would the evaporation be any greater, rain or no rain—would that assist in the evaporation, if there is no rain?

A. Why, during the falling of the water there is no evaporation.

Q. At the time the water is coming down, there is no evaporation at all?

A. I do not mean to say there is no evaporation at all, because we sometimes have it come in the shape of mist.

Q. You say that the masonry would have to go down to the solid rock. Supposing the bed of the river is solid rock, would there be any difficulty in getting down to the solid rock?

A. Not if the bed is of solid rock.

Q. You say that a dam like that would cost \$1,000,000?

A. I think so.

Q. Upon what basis do you make that estimate?

A. Upon the quantity of the material used.

Q. How long was the dam proposed to be?

A. The average length of the dam, according to the report of the commissioners there—Mr. Day's report—I estimated about 600 feet. It would be more than that with his diagram, but I took the length at 600 feet.

Q. Would it not depend a great deal upon the facility with which you can obtain the rock; the character of the rock; its adaptability for masonry; and would not the cost of the dam depend somewhat upon the facility with which you could obtain rock there?

A. Yes, sir; labor and material are the two elements in the cost.

Q. Do you know what the angles of the hills are at the dam that is proposed to be constructed?

A. I took Mr. Day's diagram there; it will be an average angle of something more than 45 degrees.

Q. Mr. Day does not give the sides of the cañon here?

A. He gives the top of the dam.

Q. He gives the top of the dam; but suppose the mountains rise 500 feet higher, and go up perpendicularly upon each side: you do not know anything about that?

A. That don't effect the sections of the dam.

Q. Would not that have a bearing on the cost of the construction of the dam, in blasting the rocks for the dam?

A. Yes, sir.

Q. Would not that be a very material point in making an estimate for the construction of a dam?

A. Of course it would be a material point, but I make the estimate upon the lowest figures that I can think of.

Q. How far do you claim that that rock would have to be hauled to make it cost \$1,000,000?

A. That it would have to be hauled 600 feet at least.

Q. What size do you give for the dam?

A. I give 330 feet bottom, cross section.

Q. And how many feet across the river?

A. Six hundred.

Q. How much did you count for labor per day?

A. I counted about \$4.

Q. How much powder did you calculate to be used for blasting?

A. I did not count the powder. I made a general estimate what the 600,000 yards of rock would cost.

Q. And all the data you have was this diagram by Captain Day?

A. That is all I went by.

Q. And you figured the cost of that dam to be \$1,000,000?

A. Yes, sir.

Q. Take 600,000 cubic yards of rock: wont the cost of the dam depend a great deal on the hardness of the rock you find there?

A. Not particularly, if you blasted the rocks.

Q. Cost no more to blast very hard rock than it does reasonably soft rock, does it?

A. No; soft rocks are not particularly good rocks to blast.

Q. How is it about drilling those rocks?

A. Oh, there is a vast difference in drilling them. There is a vast difference in that; but that is a simple element in the calculation, I think.

Q. Would you like to make a contract to build a dam in a country where you have not seen the rock; where you do not know anything about the size of the dam; where you do not know anything about the bottom of the river; where you do not know anything about the cost of material—would you like to make a contract to build a dam of that kind, where you did not know anything about it, except a little pen drawing that is attached to that report?

A. I would want to have a very good margin when I made it.

Q. Did you submit this cost to Mr. Sunderland.

A. No, sir.

Q. Did you submit the statement to him?

A. I submitted to him this paper.

Q. You say a dam like this will cost \$1,000,000 do you?

A. Yes, sir; I think it would to hold water. It is an unheard of dam, in the first instance.

Q. Are you employed as an attorney in this case by Mr. Sunderland?

A. No, sir; I have no interest in the case whatever. Mr. Sunderland is a friend of mine, and we had conversations on the subject.

Q. You thought you would give him some figures on building dams out there.

A. Yes, sir; he requested me to do so.

Q. You have stated here that, as a business proposition, this dam would cost more than it is worth. Upon what facts do you base that statement?

A. On the fact that the water is already used profitably with other mills.

Q. How do you know that?

A. From the report, which is received as official evidence.

Q. What has that to do with the profitableness of the water of this dam, as a business proposition? You have stated here that it would cost more than it would be worth.

A. Yes, sir.

Q. Now, what do you know about the revenue that would be derived from that water power?

A. I do not think that a revenue could be derived that would justify the building of the dam and the destruction of the mills that are now in existence.

Q. What do you know about that from you own knowledge?

A. Of my own knowledge, nothing, except the report which every gentleman here must be guided by.

Q. We do not want your opinion here about this report. This report is made by the commissioners. I want your opinion as an engineer. You say you are an engineer, and you have stated here that, as a business proposition, it would cost more than it is worth to build this dam, and I want to know upon what figures you based that opinion.

A. I base it upon the report.

Q. Why, there is nothing stated in the report about the revenue that would be derived from this water.

A. Nobody knows what revenue would be derived from it.

Q. How can you make that statement then, that it would cost more than it is worth?

A. Why, on general principles, that the water is already used, and it would not justify such an expenditure, even if the dam would hold the water.

Q. You are taking the opinion given in the report, but I want to know what you know about this?

A. I know very little about the river, except as I saw it out there at different points. I have stated before, that I

did not examine this river particularly. The report I take to be true. Those gentlemen made it without having any favor or fear of any body. What they stated I take to be true, and on that I based my opinion.

Q. What did you go to Nevada for?

A. To see how they were working the mines.

Q. You just passed by that river, and you saw the rocks there at some places?

A. Yes, sir; that is all. I went there for observation.

Q. You have never studied geology, have you? Can you tell syenite from trachyte?

A. I have studied geology, perhaps, as much as most gentlemen have in early days.

Q. Can you tell syenite from trachyte?

A. Yes, sir.

Q. Will you please state of what syenite is composed, and of what trachyte is composed?

A. No, sir.

Q. How can you tell the difference?

A. I know the rocks when I see them.

Q. Do they not look very much alike?

A. No, sir; not particularly alike.

Q. What is the color of trachyte?

A. The trachyte is a reddish gray color.

Q. Is it not green sometimes, too?

A. Sometimes.

Q. Is it not yellow sometimes?

A. I do not know as I ever saw it yellow.

Q. You never saw any yellow trachyte?

A. I do not know as I ever did.

Q. What color is syenite?

A. Syenite may have several colors; it depends upon what the oxides are that affect it.

Q. Supposing that water power would pay \$1,000,000 a year, would you consider that it would pay to construct a dam that cost \$1,000,000?

A. Certainly I would.

Q. How can you make a statement here, that it will not

pay to make that dam—that it would cost more than it is worth—and you do not know how much revenue will be derived from it?

A. Simply because, in former days, as an engineer, I have been consulted about building dams, and the question of revenue has arisen and the expense; and my old chief, Colonel Baldwin, was the most distinguished man as a hydraulic engineer in the country, and he invariably would say how much the water was worth, and how much the dams would cost, and determine whether it was proper and practicable to build the dam.

Q. But you say you did not do that, you did not do this—you only did a part of it. You say you estimated the cost of the dam, and did not estimate the amount of the revenue?

A. No, I did not estimate the revenue.

Q. How can you tell, then, that it would cost more than it is worth?

A. Because I cannot conceive of its being worth very much.

Q. How can you tell?

A. I think that the water, as it is now used, is quite as beneficial to the reduction of ores as it would put into one tunnel.

Q. How do you know that; there was no mill on that river when you went there?

A. No, sir; that is my opinion.

Q. Your opinion, formed without knowing anything about it?

A. Oh, yes; perhaps I do not know as much about it as you do.

Q. Did not you form your opinion upon the statement of Mr. Sunderland to you?

A. No, sir.

Q. Did you not talk matters over with him, and arrive at your conclusions from the statement of Mr. Sunderland?

A. I have talked a great deal with Mr. Sunderland, and talked with other gentlemen from the country there. The

very first conversation I had with Mr. Sunderland, I stated that this thing was impracticable, and I did not think it could be built with profit.

Q. Did you have any conversation with Mr. Requa about this subject?

A. Yes, sir. Certainly I had.

Q. Did you with Mr. Batterman?

A. I do not know. I think Mr. Requa and Mr. Batterman both spoke of the dam, and I spoke of the dam to them; but I can tell you that neither of them made any new suggestions to me.

Q. Did they not tell you the dam was not practicable?

A. No, sir; I do not know but Mr. Requa said so, but I think I said to him first that I did not think it was so.

Q. You based your opinion somewhat on the statement of others in regard to the water power?

A. No, not at all.

Q. Whose statement did you take about the water power on the river?

A. I took the statement of the commissioners and General Foster.

Q. They made no statement about it. Will you please point out where General Foster states anything about the water power now obtained on the river?

A. He makes a report here; he says the water power of the river there, when he saw it, was 25 square feet—passing through some flume—the whole river basin.

Q. You thought that that might leak at 25 feet?

A. Very easily.

Q. You did not take that as the average, did you?

A. No, sir; I took Mr. Day's statement.

Q. You mean to say now that it won't pay to make that dam, and you do not know anything about the revenue that would be derived from it?

A. No, sir; I know nothing about the revenue.

Q. Do you mean to state that it won't pay to make that dam?

A. Yes, sir; I do not think it will pay.

Q. And you do not know anything about the revenue to be derived from it?

A. No, sir; I suppose that there is a reasonable sum to be charged for water.

Q. Steam could be used; suppose that steam would be used as a power. Do you know how much they pay for reducing a thousand tons of rock a day?

A. No, sir.

Q. Do you know that they pay \$12 a ton for reducing rock?

A. I have heard that statement, and some different statements, about the price that is charged for reducing the rock. I could not say what it is. The commissioners stated it at \$10 and you deduct the hauling.

Q. How much would that be a day—1,000 tons, at \$10?

Mr. SUNDERLAND. The commissioners don't state that.

Mr. SUTRO. They do state it.

Mr. SUNDERLAND. No, I beg your pardon, they do not.

Mr. SUTRO. They state \$10 50.

Q. Suppose that is correct, without going into these figures any further; that is \$10,000 a day, is it not? If 365,000 tons are reduced, how much would that be in a year, at \$10. \$3,650,000?

A. Yes, sir.

Q. Suppose one half of that amount could be saved by carrying that water to the tunnel; that would be a saving of \$1,825,000, a year, would it not?

A. Yes, sir, on that basis.

Q. Do you think it would pay to make a dam, then at a cost of \$1,000,000, if a saving of \$1,825,000 a year could be made?

A. I do not see the saving.

Mr. RICE. Supposing that the saving be made of one half the cost of milling. If one half the cost of milling could be saved, and if the milling now cost \$10, and that milling could be done for \$5, do you think it would pay to make that dam in that case?

A. If there would be that difference, Mr. Rice

Q. Suppose that in the Carson river you would wish to utilize the water, and use it at a point below, where the fall would be 100 feet. Could that be done, could you utilize it?

Mr. SUTRO. The Colonel has never been on the ground—is not acquainted with the topography there.

Mr. RICE. My question was, whether it could be utilized; whether the water could be utilized at that point in any way.

A. You would have 100 feet to use of it.

Q. Then how would you accomplish it?

A. By taking it out of the water of the dam, and running it down through the canal.

Q. If you have to use water, what water would you have to use at the end, that would give you 100 feet?

A. There would be no difficulty in utilizing the water at any reasonable point below, if there was that fall. Oh no, you could utilize the water there at 100 feet.

Q. Only in your opinion it could not be utilized in this particular manner spoken of?

A. No, my impression is that you do not get the basin filled with water.

Q. Well, supposing you built it lower down, could not you fill your basin with water. As long as you keep alongside the rocks that are impregnated—filled with water?

A. Very well?

Q. Then as long as you keep that dam filled with water and had that fall, it could be utilized for use, could it not—below?

A. 300 feet, yes. Use all your fill, whatever you had.

By the CHAIRMAN, (Mr. NEGLEY:)

Q. What is your occupation at the present time?

A. Farming.

Q. Where do you reside?

A. In Howard county, and in Washington.

Q. In Maryland?

A. Yes, sir; I still hold my citizenship in Maine.

Q. How long since you visited the mining regions?

A. I have not been there since 1863.

Q. At that time was the quartz mining carried on there very extensively?

A. They were quartz mining all through the country, then 1863; in 1861 they were mining all this Territory.

Q. Did you form any opinion as to the richness and extent of the auriferous deposits in the vicinity of the Sutro tunnel?

A. No, sir. No Sutro tunnel was spoken of when I was in the vicinity. I was there in 1861. I visited that country, and believed it to be very rich. They had opened their mine then, particularly the Ophir; I went more particularly to see the machinery they introduced there than anything else. The time I spent there was simply for observation.

Q. As an experimental work, demonstrating the extent and richness of these lodes, would it justify the Government to expend any considerable sum of money?

A. That is a question I would not like to answer. It is not a scientific question. The fact that the miners are developing that region more rapidly than any mining region that has ever been developed, would induce me to say that no other effort was necessary.

Q. Has it not been found to be a wise policy on the part of the Government to expend considerable sums of money in pioneer investigations?

A. No doubt.

Q. Have not such expenditures been very profitable to the whole country, and especially to those who follow the mining industries?

A. I do not think that anything the Government has done has aided much in the development of mines. Usually all mining regulations are made by the people who first make the discoveries.

Q. Have not the geological reports, published from time to time under the auspices of the Government, attracted capital and enterprise to those regions of country?

A. Well, I have doubts about that. Starting in with

Ross Browne, a people who know no more about the mining region and mining than children, they made the whole thing ridiculous from their descriptions. I do not think any of the publications, except this last publication, which I have seen here, and which I do not own—by the way, I am sorry to say—is of any real use.

MR. SUNDERLAND. Are you speaking of Mr. King's report?

A. Yes, sir; of Mr. King's report.

By MR. SUNDERLAND:

Q. Did you ever know anybody to invest in a mine anywhere on the Pacific coast, on account of a report from any expert who has published works on his own account, or any geologist employed by the States or by the Government?

A. Not from any printed books.

Q. What opinion is entertained amongst miners on the Pacific coast of these Government geologists?

A. Well, the opinion is not as good as it ought to be, I think; but they have no great confidence in them—none at all. My opinion is that a good many of them are valuable.

Q. Have you ever known the Government to expend any money for the development of mines anywhere?

A. No, sir; not to my knowledge.

Q. Or running a tunnel?

A. Not to my knowledge.

Q. Or assisting in any mining enterprise on the Pacific coast?

A. I never knew of any.

Q. Is the Government assisting mining in Arizona now?

A. Not much, unless Crook is doing it.

Q. Has there ever been any protection to miners there by the Government?

A. No, sir; except the general protection: they claim to have put in soldiers there to clean out the Apaches, but they have done very little about it. We have had legisla-

tions and commissions there, that have interfered with the mill men in the performance of their duties.

By the CHAIRMAN:

Q. Would not the construction of railroads into the mining districts, through the aid of the Government, be a contribution to the development of those mining interests?

A. No question about it.

Q. Would not that be a direct aid on the part of the Government of a very beneficial nature?

A. Of course it would.

Q. Would not the chief object of constructing those roads in those regions be to reach the mineral wealth?

A. It would be to develop the mineral wealth.

Q. Would not it be a judicious expenditure?

A. I think so, inasmuch as it develops the public domain.

HEARING SATURDAY, MARCH 23D.

On the assembling of the committee,

Prof. R. W. Raymond, United States Commissioner of Mines, appeared before the committee, and stated that he came there under orders from the Secretary of the Treasury, issued in accordance with request contained in the following letter from the chairman, General NEGLEY.

"HOUSE OF REPRESENTATIVES,

"WASHINGTON, D. C., March 19, 1872.

"Hon. GEO. S. BOUTWELL.

"SIR: The Sub-Committee of Mines and Mining, investigating the Sutro tunnel project, desire the testimony of R. W. Raymond, United States Commissioner Mines and Mining.

"Will you please request him to report to me?

"Yours, very truly,

"JAS. S. NEGLEY,

"Chairman."

"TREASURY DEPARTMENT, March 21, 1872.

"Respectfully referred to R. W. Raymond, Esq., United States Commissioner, etc.

"J. H. SAVILLE,

"Chief Clerk."

R. W. Raymond, called and examined.

By Mr. SUTRO:

Q. You are the United States Commissioner of Mining, I believe?

A. Yes, sir.

Q. Are you by profession a mining engineer?

A. Yes, sir.

Q. Will you please state to the committee where you have studied mining, and the sciences appertaining to mining?

A. I made my professional studies at the University of Heidelberg and Polytechnic School at Munich, and the Mining Academy of Freiberg, in Germany.

Q. Will you please state what particular studies are usually considered necessary?

A. A mining engineer may be only prepared in a cer-

tain branch, or he may take a wider course, and devote himself to both mining, engineering and metallurgy. For a complete course he ought to study also geology, mathematics, mechanics, civil engineering, and chemistry.

Q. Are those different branches studied at the Academy of Freiberg?

A. Yes, sir.

Q. Have you visited any of the mines of Europe?

A. While I was a student I visited quite a number.

Q. You devoted yourself entirely to the study of mining and examination of mining districts?

A. Very largely, for some years.

Q. Since your return to the United States have you visited any of the mining districts in this country?

A. I was some five or six years in practice as consulting engineer, and in charge of works in various eastern States, and for the last four years I have been traveling in connection with my office as commissioner.

Q. Are you connected with the Engineering and Mining Journal?

A. I have been editor of that paper for about six years.

Q. Have you any connection with the American Board of Mining Engineers?

A. There is a society of mining engineers called the American Institute of Mining Engineers, numbering about 200, I think; I am at present president of that society.

Q. What mining districts have you visited east of the Rocky Mountains? In what States have you visited mines?

A. We have no mining districts, in the technical sense of the term, east of the Rocky Mountains; but I have visited mines in Maine, New Hampshire, Vermont, Kentucky, New York, Pennsylvania, New Jersey, North Carolina, Georgia, and may be other States. I do not recollect at present.

Q. What mining districts have you visited in the Territories of the United States?

A. It is really hard to enumerate the mining districts there. I have visited a large number in California, a large

number in Nevada, and a large number in Montana, Idaho, Oregon, Utah, and Colorado.

Q. You are quite familiar, then, with the mining interests of this country?

A. Yes, by my own observations, and from field-notes of a great many agents I have to use. I have between one and two hundred correspondents, in different districts.

Q. In the official position you now hold, you have correspondents at all the different mining districts, or the principal ones, have you?

A. Yes, sir.

Q. That gives you full information of the progress and the improvements which are made in those different mining districts?

A. I try to have very full information.

Q. You make an annual report to the Government in regard to mining in those districts?

A. Yes, sir.

Q. What is your opinion as to the value of the mining resources of the country?

A. That requires a long answer. I do not think that there is any other country in the world with an equal amount of mineral resources. I suppose that is a well-ascertained fact, if that is what you mean by that question.

Q. Do you mean to say that there is no other country in the world that has an equal amount of mineral wealth to the United States?

A. So far as my observation and reading go I do not think there can be any other country.

Q. Do you think there is any country that ever possessed mineral interests as extensive as those owned by the United States?

A. If you mean by the term extensive, area of territory and prospective as well as present value, I say no. I suppose there have been countries that have produced in a single year as much treasure as we now produce in a single year, without any doubt.

Q. I mean the general wealth contained in our mineral domain?

A. Well, if you mean resources——

Q. I mean general resources.

A. I have always supposed, and I believe now, we are ahead of the world in that.

Q. Do not you think, Professor Raymond, that some day it will form one of the most important, if not the most important, resource of this country?

A. It will be one of the most important. I do not think mining can ever be more important pecuniarily than agriculture.

Q. Taking into consideration the question of our mineral domain, if the mining interests were to be fostered and developed, would it not probably form almost the most important interest that this country has?

A. Well, if you will allow me to make a statement in reply to that in my own words, without answering categorically, I will state simply, that the mineral wealth of any country is an absolute necessary element to any commercial supremacy of that country, in my opinion. There is just this difference between the agricultural wealth and mineral wealth—that the mineral resources of a country are of a certain quantity, which may be exhausted, and they ought to be economized, because when they are, in the course of time, by neglect or waste, diminished or exhausted—economically, if not absolutely exhausted—then the decline of the commercial supremacy of that country would commence, in spite of its agricultural resources. I think we have an instance of that in the prophesied exhaustion of the coal mines of England, which will take place, whether there is any more coal in the mines or not, just as soon as the coal is so far worked out that they cannot produce it as cheaply as other nations. That is an economical exhaustion. It does not make any difference whether there is any coal there or not; if it comes to a point that it cannot be extracted economically, that is the end of it. I have explained all this in one of my former reports. I there-

fore think that the mineral resources of the country are a highly important trust of the Government.

Q. Would you not consider, then, that an economical, intelligent, and rational system of mining would be highly desirable for this country?

A. I do.

Q. What is the first requisite in opening mineral regions—is it not capital?

A. That is one necessity.

Q. Are not mining operations at this day carried on to a large extent simply for speculative purposes?

A. There is a speculation involved in mining any how. If you mean speculations as to the success of the mining enterprise, why of course. If you mean speculation as to merely selling stocks of mining companies, that is also true.

Q. Is that sort of operation detrimental to the general welfare of the mining interest?

A. That I cannot answer. I do not know. Speculation seems to be a part of all enterprises in our country at the present time. I am very strongly impressed with the idea that it more or less injures the regular industry, but I do not know positively. That is a question of political economy as to whether it is a positive evil.

Q. Are not the mines in many portions of Europe carried on so that they pay regular dividends for many years in succession?

A. Yes, sir; they are. That is often the case.

Q. Do they not carry on their explorations and open up their bodies of ore, so that they have always some years' work ahead for their mills?

A. That is very generally the case. I think that such mines as are under the Government supervision do.

Q. Where is that, in Germany?

A. Yes, sir; in all the States of Europe where the Government has had mining bureaus or mining departments administering the mining industry. Whether that is the case when the mines are wholly owned out and out by private parties I am not able to say. The only instance that

It is only from reading a report of the engineers. I thought it was about 1,900 feet, but it may be 2,200. The Sampson shaft, which is much deeper, is not near this tunnel.

Q. That is 2,700 feet?

A. The diagram shows that very plainly, Mr. Sutro, that the shafts are deeper than the tunnel; before this Ernst-August tunnel was constructed, there was another tunnel in existence there, called the deep-George tunnel, under the church of Clausthal, which had a depth of 900 feet.

Q. Do you recollect the length of that tunnel?

A. I think it was $6\frac{1}{2}$ miles. I do not remember. I remember that the deepest—the new tunnel—was a great deal longer than the other, and that it was constructed with a great deal of engineering skill; and I have been more interested in the details of the work than I have been as to anything about the previous tunnels—those that were superseded by it. The deep-George tunnel was an old affair, made and finished long before I ever went to Germany to study.

Mr. SUNDERLAND. I wish to object to this testimony, as not being embraced within the report of the commissioners.

Mr. SUTRO. Why, Professor Raymond has been called here, if I understand correctly, by the committee, as an expert, and as a United States officer. He has charge of the mining interests of this country, and is called here by the committee to give some information on this subject.

Mr. SUNDERLAND. So was General Foster——

Mr. SUTRO. General Foster was called here as one of the commissioners, and examined as to a special subject. Professor Raymond is the commissioner who has charge of the general mining interest of this country. There is a mining question that arises before this committee, and, if I understand correctly, it is desirable to have all the information upon this general mining question that can be obtained, and I think it was the intention of the committee to call Professor Raymond with that view.

The CHAIRMAN, (Mr. NEGLEY.) It is not a parallel case;

that of Professor Raymond and General Foster. By an agreement, the testimony given by General Foster, when he was recalled, was to be confined to an explanation of a statement of the evidence which he had before given, and to the subject-matter of his report. Professor Raymond occupies now about the same position that the other gentlemen did who were called. You were permitted to give such testimony as was relative to the subject-matter. Of course Professor Raymond will not be permitted to give irrelevant testimony—

Mr. SUNDERLAND. I simply made the objection, Mr. Chairman, because I understood the committee to announce at the time that General Foster was recalled that the committee would not go into anything beyond the subjects embraced in the report of the commissioners.

The CHAIRMAN, (General Negley.) Do you find anything in the evidence given by Professor Raymond that is not relevant?

Mr. SUNDERLAND. I do not say it is not relevant, but I say it is not embraced within the report of the commissioners. That is all.

Mr. RICE. There was no restriction whatever when the commissioners were first called. We went through the examination of the three commissioners fully, and without any objection on any side; not confining them to the subject-matter specifically of their report, although it naturally took that tendency. When General Foster was recalled, the point was raised by us that, he having been examined fully on the one side and the other, and dismissed, it was not proper that his testimony should be reopened, to admit new matter, and the committee so ruled. That is my recollection.

Mr. SUTRO. That is correct.

Mr. RICE. I suppose any testimony that has a bearing upon this question, without regard to the Sutro tunnel or to the men owning the mines, or anything bearing upon the interests of the Government in this country, would be perfectly relevant and very important to obtain in this examination.

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Examination resumed.

Q. I wanted to ask you, Professor Raymond, whether you do not consider that they look upon tunnels as of very high importance, and if we find they have constructed a tunnel 14 miles in length, which is but 300 feet below the tunnel which had been previously constructed to the same mines——

The WITNESS. What is your question?

Q. The question is, "Whether they do not look upon the construction of tunnels as of the very highest importance?"

A. I know they look upon tunnels as of very high importance. It does not need any argument to prove that. I know it.

Q. Is not this a striking fact, that in mining districts, 300 feet is considered sufficient to authorize the construction of a new tunnel?

A. It is a very common fact that 300 feet are sufficient, in the old mining districts of productive mines, in that country, in their opinion to justify the construction of a new tunnel.

Q. A tunnel 14 miles in length?

A. Yes, sir, that is the longest tunnel.

Q. They look upon tunnels then as auxiliaries to mining, and of absolute necessity?

A. I do not like the term "absolute necessity." They look upon them as of the highest importance, and an economical necessity.

Q. Do they carry on mining in those countries with intelligence?

A. Yes, sir.

Q. Do they apply all the sciences and all the experiences that have been made for centuries, and use them in furthering the mining interest?

A. They do.

Q. They never take any decisive steps in mining there without careful scientific consideration, in view of all the circumstances?

The WITNESS. I did not understand Mr. Sutro's question perfectly. I supposed he was asking whether they brought to bear science in the operation of these works.

Q. Do they not have the most experienced engineers and Government officials, who take into consideration these measures?

A. That is a part of their mining system.

Q. And that they arrive at the conclusion that these tunnels contribute very much to the development of their mines?

A. Yes, sir. Wherever tunnels are feasible, I think they run them, in connection with the development of the mines.

Q. Would you consider that the tunnel to the Comstock lode, which in a distance of 4 miles, cuts the mines to the depth of 2,000 feet, would be a desirable point to be attained?

A. Yes, sir; I have always thought so.

Q. Do you think that such a tunnel, as a general mining proposition, would contribute largely to the profitable working of those mines?

A. Why, yes, I think that such a tunnel would be a very important assistance in the proper working of the Comstock lode.

Q. Does not a tunnel of that kind, embracing a whole series of mines, or a mining district, open up a new basis of operations at a depth of 2,000 feet?

A. Yes, sir.

Q. Are you personally acquainted with Baron Von Beust, who was in charge of the mining departments of Saxony?

A. Well, yes, as much as students are likely to be personally acquainted with the president of a college. He was the head of the Freiberg school at the time of my studying there. I cannot say that I was personally acquainted with him.

Mr. SUNDERLAND. I suppose the character and reputation of that gentleman is sufficiently established without proving it by witnesses.

The WITNESS. I should hardly think my testimony was necessary on that point.

Q. In a letter addressed to me by Baron Von Beust, in October, 1867, he states:

"A deep adit of the proportions of the Sûtro tunnel, having a length of 6,000 metres, together with four shafts of a probable entire depth of 1,200 metres, which have to be provided with steam-engines, could not in very favorable rock formations, as they are said to exist in the Comstock range, be constructed in Germany for less than one to one and a quarter millions of thalers. With the price of American labor and fuel, as they exist in that neighborhood, three millions of dollars may therefore be considered as a fair estimate.

"In regard to the time required, I should not like to estimate it at less than eight years, at the same time basing my calculations upon very favorable rock formations, great energy in execution, and the non-occurrence of special casualties, which may occur in such operations notwithstanding all precautionary measures.

"But this expenditure of three millions of dollars and eight years of time, which, as already stated, I simply put down as the probable result from very general experiences, would, according to my views, be *insignificantly small, compared with the results* which would be achieved thereby, particularly if not only the direct financial advantages are taken into consideration, but also those of a politico-economical nature, which would consist in having placed for all times on a solid foundation, the most extensive gold and silver mines which are known to modern times."

Q. You indorse what Mr. Von Beust states here?

A. As a general proposition, yes, sir.

Q. Are you acquainted with Mr. Bernhard Von Cotta, the professor of geology at the Mining Academy of Freiberg?

A. I am.

Q. Do you know him personally?

A. I do.

Q. What reputation does Mr. Von Cotta enjoy as an authority upon mineral lodes and mining?

A. He is the author of the best works on mineral lodes, I suppose, that have been written.

Q. Is he not looked upon as the highest authority that we have anywhere?

A. He is very high authority indeed.

Q. Mr. Von Cotta, in a letter written October 31, 1867, addressed to me, states as follows:

"After having read Von Richtofen's superb treatise on the Comstock lode, which, as far as the establishment of facts is concerned, thoroughly bears the

seal of truth, I feel justified in answering your four questions, from a full conviction, as follows:

"1st. It is beyond doubt that the Comstock lode, as a genuine fissure vein, will continue downwards in greater depth than it will ever be possible to reach by mining, and that this mighty deposit within any depth which can be attained, will be ore-bearing in the manner Von Richtofen supposes.

"2d. Accordingly there can be no question about it, that the opening up of the lode by a deep tunnel will facilitate, to quite an extraordinary degree, mining upon the same, and in every other regard make it more profitable.

"3d. The advantages in working the mines upon the Comstock lode by means of the tunnel proposed by you (the Sutro tunnel) will, as concerns the main lode, principally consist of:

"a. *In facilitating drainage and ventilation.*

"After all the mines are connected with the tunnel, no engines will any longer be required for this purpose, and even before such connections are established, the completion of the tunnel would likely drain off considerable water through the fissures of the lode.

"b. *In facilitating transportation,* not only of the ore from the mines, since reduction works may be established near its mouth, but also of the materials and timbers required in a portion of the mines.

"c. *In facilitating the entry and exit* for a portion of the mines.

"d. In any case the possibility will be acquired, by means thereof, to work the lode to a much greater depth than without the tunnel.

"N. B. The concentration of ores in the neighborhood of a river can in all probability also be attained better and more advantageously than on the side of the mountain.

"It is probable in the highest degree, that the tunnel will open up new and similar lodes, which in this neighborhood seem to run mainly from north to south, and which will be found particularly in the rocks which form the hanging wall eastwardly from the main lode."

Mr. SUNDERLAND. I object to lumbering up the record here in this way. This is a book that can be used before the general committee on argument; and therefore it seems to me unnecessary to lumber up the record with these extracts of letters. They are accessible to anybody who wants to read them in this book. It is simply an unnecessary consumption of time.

The CHAIRMAN. If Mr. Sutro desires to put them in as evidence, of course he can do so, by making reference to them, or by reading from them. In either case they would become part of the record. I do not see how we could exclude them. He desires to put them in evidence, and they are relevant matter. The object Mr. Sutro has in referring to them would seem to be, to obtain the opinion

of the witness, who is personally acquainted with these gentlemen.

Mr. SUTRO. He knows their reputation fully.

The WITNESS. Allow me to say, it puts me in a difficult position, because to ask my indorsement of a whole letter is a very different thing from asking my opinion of the inference of the writer. I have just stated, for instance, that I indorse Professor Von Cotta as one of the highest living authorities on the subject. Now, the question is whether I indorse all that letter opens up—every point in the letter. It therefore becomes not a question of Professor Van Cotta's reputation, but of my individual opinion.

Q. I desire to remark, that I do not wish you to go into the details of that letter; but, as a general proposition, I ask you whether you indorse what Mr. Von Cotta states there as a general proposition, without going into the details of each statement he makes.

The WITNESS. As a general proposition, I would agree with it. There are some things in the letter that I do not agree with, and it is perfectly consistent with my highest opinion of Professor Von Cotta; because he would not himself say some things there on the information that he could get now; as, for instance, that the tunnel itself, before being connected with any of the mines, would drain the fissures in the lode, because it is evident from experience that the majority of the water in the lode is shut up in such a way that no single tunnel would drain it without connections.

Q. Will you please allow me to again read what he says in regard to that?

"After all the mines are connected with the tunnel, no engines will any longer be required for this purpose, and even before such connections are established, the completion of the tunnel would likely drain off considerable water from the fissures of the lode."

He does not state it would drain off all the water, but he states it would likely drain off considerable water. Would you not indorse that statement?

A. Yes, sir; it is probably true that the tunnel would drain some of the water.

Q. Then you do not find any objection——

A. I did not take any serious objection to the letter, but I wanted to understand whether I was committing myself to every detailed proposition.

Mr. SUTRO. I do not understand it that way.

Mr. SUNDERLAND. I submit, Mr. Chairman, it is not very fair to the witness nor to anybody to read a long letter upon a great many points, and then to ask the witness if he indorses the whole letter, without calling his attention to the points made in the letter.

The CHAIRMAN, (Mr. NEGLEY.) The objection will be sustained. Mr. Sutro hereafter, in referring to these letters, will state what points he wishes the witness to speak about.

Q. Do you know Professor Weissbach, professor of mechanics, civil engineering, and surveying?

A. I did know him—he is dead.

Q. Was he one of your professors at the time you were there?

A. Yes, sir.

Q. What reputation does Mr. Weissbach enjoy as a man of science—as a mechanical engineer?

A. The very best in the world.

Q. Are not his books used in every school, in every university, you may say, in the world?

A. I do not know how that is, but they are used in every country where there are schools and universities.

Q. Would you consider his opinion upon the value of the tunnel, or upon the practical mining operations, worthy of the highest consideration?

A. Very high indeed, and especially upon any matters connected with mechanics and application of power, in his special department. Professor Weissbach was professor of mechanics and the use of power and machinery in mines and of mine-surveying.

Mr. SUTRO. I ask you these questions, since I find a letter here addressed to me about the same time these other letters were written in regard to this tunnel, in which he highly indorses it.

Q. Have you ever heard of Dr. H. Von Dechen, actual privy councillor of the King of Prussia, and late chief of the mining department?

A. I have heard of him. I do not know him. I do not know anything further about him.

Q. Do you know his standing as a mining engineer, or as authority in mining matters?

A. I merely infer from his office what it is.

Q. Could a man hold that position under the King of Prussia, unless he was a man of the highest scientific attainments?

A. I do not think he could.

Mr. SUNDERLAND. I do not call in question the reputation of any of these gentlemen.

Mr. SUTRO. I want to introduce this evidence as an offset to the statements of those superintendents, who have admitted that they never have been in any mining district, or ever have seen any mine but the Comstock lode; and who do not profess to know anything about mining, except what they have learned there.

Mr. SUNDERLAND. They may know a great deal more about the Comstock than these men who have never had any practical experience.

Mr. SUTRO. No doubt they know more about stock-jobbing.

Q. Here is a letter from Mr. H. Koch, royal Prussian chief mining councillor, dated at Clausthal, November 1, 1867. Are you acquainted with Mr. Koch?

A. No, sir.

Q. Here is a letter from Mr. Bruno Kerl, professor at the Royal Mining School at Berlin, dated November 11, 1867, in which he highly indorses the tunnel. I will read just one little sentence from that letter:

"Only by means of such a tunnel—as one has, for instance, been constructed in the Harz, under the name of Ernst-August tunnel, but under circumstances by far more unfavorable than yours, can a metalliferous mountain range be opened properly—according to the principles of mining engineering; a well regulated extraction can take place with such a tunnel, and poor ores may be taken out to advantage along with the rich ores, on account of cheap transportation.

"This is absolutely necessary, if the durability of a mine is to be secured, while *piratical mining*—the extraction of the best ores—alone will always ruin any mine."

Q. I have not had an answer to my question whether you know Mr. Bruno Kerl?

A. You have not asked it.

Mr. SUTRO. Well, I will ask it now.

Q. What standing does Mr. Kerl occupy as a scientific man in Europe?

A. Professor Kerl was formerly Professor at the School of Clausthal, and was called from there to Berlin, which was a very high compliment to him. We regard him as one of the foremost men in the mining science in Germany. He is especially distinguished as the author of the best books on assaying and reduction of ores. That book has been translated into English, and is used in England and in this country.

Q. Do you agree with Mr. Kerl when he says that it is absolutely necessary to extract poor ores together with the rich ores, in order to secure the durability of a mine, while *piratical mining*, or the extraction of the best and leaving the poor ores will ruin any mine?

A. That is true enough.

Q. Is not that your own experience in this country?

A. That is my observation.

Q. Do you entirely agree with him on that point?

A. I do.

Q. Were you acquainted with Mr. A. Daubrée, Inspector General of the Mines of France?

A. Not at all.

Q. Do you know him by reputation?

A. I know him by his writings and his reputation.

Q. Were you acquainted with Rivot, professor at the Mining School of Paris?

A. I knew him as the author of Rivot's Metallurgy, and a very distinguished man he was.

Q. Was he not considered one of the first scientific men in France, in that branch?

A. I believe so.

Q. Would you consider his opinion in regard to the value of the construction of a tunnel in a mine worthy of high consideration?

A. I suppose from his general standing it would be. I do not know anything about him personally.

Q. Do you know Sir Roderick Murchison, Warrington W. Smythe, and Ramsey?

A. I know of the two former.

Q. What standing did they occupy as scientific men?

A. Sir Roderick Murchison was a leading geologist of England. I am not aware that he had any experience as a mining engineer. Mr. Smythe is one of the best mining engineers of England. He is professor of the mining and engineering department of the London School of Mines.

Q. Would their opinion in regard to a mining question be very valuable?

A. I should think Mr. Smythe's would be very valuable. I do not know anything about Sir Roderick Murchison's, although he is a very eminent man.

Q. Would you consider Mr. Smythe's opinion as valuable as that of a superintendent of a Comstock mine, who had never studied mining?

A. I prefer not to answer that question.

Q. Did you ever hear of Mr. Rittinger, councillor of the mining department; and a member of the Imperial Society of Vienna?

A. Yes, sir.

Q. Have you seen his work?

A. I am familiar with his book.

Q. Is not his work on concentration of ores looked upon as one of the most valuable works we have in mining?

A. It is.

Q. Is it not a work that is used in all the mining schools?

A. It is considered as the best authority, I believe, or one of the best.

Q. Would you not consider his opinion in regard to mining questions of the highest value?

A. I should think so, especially if it referred to concentration.

Q. Are you acquainted with Baron Otto Von Hingenau, doctor of law, councillor and member of the Imperial Austrian Ministry of Finance?

A. No, sir.

Mr. SUTRO. I will not take up your time any longer with these letters. I thought I would refer to the authors, since you have studied under many of them, and they being the great authorities of Europe in regard to mining questions. I now want to ask you what influence the introduction of a rational system of mining, in the most important mines we have in this country, would have upon all the other mining districts of the United States.

A. Well, the successful introduction of a more economical system of mining at any important mines, would have, in the first place, the influence of a good example on all the others, and be a great encouragement, I suppose, in other districts suffering from the same difficulties overcome by that reform.

Q. Would it not serve as a pattern? If successful, would it not induce capital to flow in that direction?

A. Experience in other countries is, that the introduction of any such new system serves very decidedly as a pattern, and leads to wide imitation. The way in which it might induce capital to come in would not be from its being a pattern principally, but from the encouragement it might give in the way of permanence of investment.

Q. I mean to say, if this should be a great financial success, would it not have a tendency to make capital flow into the mining districts, and induce capital to enter into similar enterprises throughout the mining regions, where the conditions admit of tunnels?

A. I think that is a self-evident proposition.

Q. Do you recollect the difficulties that were encountered in the construction of the first railroad?

A. No, sir.

Q. Have you read about them?

A. I have, sir.

Q. Have you read about the immense impetus that was given to railroad building as soon as it was ascertained that it was a success?

A. I know that it is the case from history.

Q. Would not the successful investment of three or four or five millions of dollars in a single mining work encourage capitalists to enter into similar undertakings, provided that enterprise should prove a great success?

A. I think it would, as I said before.

Q. What do you think of the importance of producing and increasing the production of the precious metals in the politico-economical sense.

A. I think I had better be excused from going into political economy. I am not an expert in political economy. Any gentleman of the committee is better able to decide about that point than I am.

Q. This is a general inquiry with regard to the mining interests and the development of our mines; and I will confine my question to a single one. I simply want to ask you whether the increase of the quantity of the precious metals, as a general proposition, has not a tendency to depreciate the value of those metals, while, on the other hand, it appreciates the value of all commodities?

A. Well, as I say, that leads me into political economy, and my views may not be particularly sound. I do not profess to be an expert in regard to that. If it depreciates the value of the precious metals, and appreciates the value of other products, in that depreciated standard, then I do not know that it necessarily changes the real value of the other products.

Mr. SUNDERLAND. It will change the nominal value?

A. It would have this effect. It would undoubtedly benefit all debtor classes, because it would decrease the value of debts; because people who had contracted to pay money

would find it easier to pay, if other things had gone up and money had gone down in the mean time.

Q. Then, taking into consideration that statement you have just made, would it not be of great value, great importance to the United States, having an immense national debt to encourage and develop the mineral resources of the country?

MR. SUNDERLAND. I object to the question. It is one that any of us can answer.

MR. KENDALL. This is a question any member of the committee can answer just as well as the witness, and answer it to satisfy himself. I suppose we all know what effect the increase of the precious metals would have, and I see no use in cumbering up the record with things that are self-evident.

MR. SUTRO. Mr. Chairman, we have a gentleman here to-night before the committee who has been engaged in gathering all the information possible as to our mineral resources. In connection with the development of our mineral resources, it is, I think, very necessary to find out what influence that will have upon the payment of the national debt. I do not see why any gentleman should object to a question of that kind.

THE CHAIRMAN. That is a deduction. It does not follow that the line of investigation leads us into questions of political economy.

MR. SUNDERLAND. We draw our own deductions, you know. As I understand, the committee want facts.

MR. SUTRO. I will drop that question. I did not want to waste your time by going into long dissertations on political economy. I want to recur again to the question of tunneling—to come back to the main subject, and to ask you whether there are not greater advantages created by having a deep tunnel in mines, in enabling the water which may be collected in mines to be used as a water power?

A. Undoubtedly.

Q. Does not this tunnel level, which in this instance

enters at a depth of 2,000 feet, open up an entirely new basis of operations from that point down?

The WITNESS. By virtue of the power?

Mr. SUTRO. By virtue of the power; by virtue of the ventilation; by virtue of creating, in fact, a new place to begin with?

A. I have answered that already, that it does.

Q. And now, in regard to the water power that may be obtained from the water contained in the mines, and also from water collected on the surface and carried down the shafts, do you know of any place where that water is economized and employed for generating power?

A. I regret to say that, in this country, so far as my observation has gone, I can recollect of no instance in which our miners have used such a power, although there are a great many places in mining districts where it could be and ought to be used. The use of underground water powers, both water wheels and hydraulic engines, in foreign mines, is very common and sometimes very extensive. I know of one system of mines in the Austrian Duchy of Salzburg, where nine such engines are at work in raising brine and transporting it from one village, where it is mined, to another, where it is boiled down; they are also used at Freiberg, and several of them are used at Mansfield and in Hungary.

Q. What sort of machinery have they for using this water power?

A. It is a regular hydraulic engine, such as you will find in a great many of our manufactories, in the Bessemer Steel Works, and in various manufactories where very high pressures are required to be produced. But in such cases the pressure is artificially gotten up first by a force pump, and then conducted into hydraulic engines; whereas in mines the pressure is obtained by the height of the shaft from the reservoir down to the place where the hydraulic machine is located.

Q. Does not a small quantity of water with a great fall create an immense power?

A. Any quantity of water with any fall creates a power equal to the water multiplied into the fall.

Q. Suppose you had 50 gallons per second in a fall of 2,000 feet.

A. 50 gallons a second is about 500 pounds; multiplied by 2,000 feet=equal 1,000,000 foot-pounds.

Q. Please state how much that would be, divided by 33,000 pounds?

A. Eighteen hundred and fifteen horse-power.

Q. That would take the place of a good many steam engines, would it not?

The WITNESS. You could not obtain 1,815 horse-power net, but you get a very large per centage of it, I think 75 per cent.

Q. That would give us how much?

A. Some where about 1,300 or 1,400 horse-power.

Q. That water power could then be employed in pumping the water from below the tunnel level, for the purpose of hoisting rock, and taking men in and out?

A. It is a very excellent power for pumping water from below the tunnel level, but for the purpose of hoisting rock and men, I think a simpler use could be made of the same head of water.

Q. In the particular use you would employ it, would it be for pumping water?

A. I think so.

Q. Why would it be particularly desirable to use this power for pumping?

A. Because the motion of a hydraulic engine is almost exactly the motion that is required for a pump-rod, and without any extension or troublesome gearing, we can link a pump-rod to the hydraulic engine and produce directly the pumping motion. For lowering or hoisting men or ore in some cases, when the distance is not great, the best use to be made, in my opinion, of the head of water, is what is called the water-hoist, which you will find in use at our principal iron furnaces, where you have to hoist coal and ore to the top of a furnace 50 or 60 feet high. In that

case you fill a tank with water at the top, and that balances the platform on which they run the coal or ore; and as the tank goes down, the platform goes up. When the ore or coal reaches the top of the furnace, they roll off the load there and discharge it into the furnace. The platform is then empty, and the tank full of water is at the bottom. They open a valve in the bottom of that tank and let the water out, and the tank becomes empty, and the platform is heavy enough to pull it up: so that, by letting down a cargo of water on the one side, you are able to pull up a cargo of ore or men on the other side. That is a very simple way of applying the power.

Q. Why could not that simple way be employed in the mines, providing this tunnel was connected with shafts, and you have a double shaft with a rope going over a pulley, having a water-tank on the one side and a cargo on the other? Why not, by letting down the water—filling this tank with water, and lowering it down—why could you not take the men or timber up, taking in a supply of water at the top of the shaft sufficient to give you that power?

A. That is a very good way, provided the length of rope, &c., is not too great.

Q. We have one mine alone where they have been pumping out 411 tons of water every day.

A. I do not know anything about that.

Q. That would hoist a good many men.

A. I simply want to give you the general principle that, if at the top of the shaft you have weight enough, with water to let it down that way, and let it run out at the bottom, that that is a very good way arranging a simple, cheap water power. It is a primitive mode, and not very rapid. I do not know how rapid it might be made, but, in practice, for instance, where you use it for small hoisting, of course the difference in weight between one side and the other is made as small as possible, so as to save water, and the natural result is that that does not produce a very swift motion. It may be, by loading the water-tank more heavily it could be made swifter also.

Q. Suppose you put two tons of water on the one side, how many men could you hoist up pretty rapidly?

A. That would depend a great deal on the length of the rope it had to hoist.

Q. Supposing a rope is attached to the bottom of the tank and to the bottom of the other car, would not that balance it?

A. That balances.

Q. Suppose the apparatus be fixed in that way, how much would it hoist?

A. That balances, but the length of rope is still an item to be considered, because it makes so much weight to be moved, although it balances.

Q. Since we are on the subject of hoisting ore, I want to ask you whether, by having this same apparatus, with a car on each side, connected with a rope going over a pulley, if we had ore at the top—whether, by putting ore on the one side, that would not hoist up the men?

A. I have seen that done frequently.

Q. That is a very simple operation, is it not?

A. Very.

Q. It would hoist up timbers too; would it not?

A. The difficulty in the operation does not lie in any mechanical laws, but in a systematic arrangement.

Q. Where men are at work, mining is going on, is it not? The men are not in there doing nothing, are they? and consequently where they are mining, they must take out waste rock, or they must take out ore—one of the two?

Mr. SUNDERLAND. Mr. Chairman, I object to Mr. Sutro arguing the question with the witness. The witness is to be asked questions.

Mr. SUTRO. I am not arguing with the witness; I asked the witness if when men were in the mine they were not doing something there. That is a question. It is no argument.

Mr. SUNDERLAND. I made my objection to the chairman.

The CHAIRMAN, (Mr. Negley.) I prefer having the questions put direct, as nearly as possible.

Q. I want to ask whether men are not supposed to work when they go into a mine—laboring men?

A. Yes, sir.

Q. Then I want to ask you whether, when they go into a mine, they do not take out waste rock or ore?

A. Not always.

Q. May be they are timbering?

A. Yes, sir.

Q. Suppose there have been regular mining operations going on, and you take out the waste rock or ore. I do not mean to say during any particular 10 minutes or half hour, but during the working hours of the day, are they not taking out either rock or ore?

The WITNESS. I am only trying to make my opinion clear. The trouble is not to arrange to hoist men by letting down the ore, for that is perfectly feasible. The difficulty is, to always have ore when the men are coming up.

Q. Do you see any practical difficulty in having car loads of ore ready always when you are going to hoist the men?

A. I think it could be arranged.

Q. Do they not always work two or three shifts in the mine, and when one shift gets ready to go out another goes in?

A. Certainly.

Q. Can there be any difficulty, then, in arranging for the lowering of this ore every time they want to hoist these men?

A. I do not see any practical difficulty. There is the difficulty of inconvenience in arrangement. It is not an insuperable difficulty. It is perfectly feasible to carry out the thing: at the same time it is not in all respects as convenient as it is to have an independent man-engine taking the men up and down.

Q. You remind me of a subject that I want to ask you a question about. I had not thought of it before. The subject has never been alluded to as yet, and that is this

subject of the fahrkunst. You have seen those in operation in Europe?

A. Yes, sir.

Q. Are they not commonly used in the mines there?

A. Yes, sir; and we have them in this country.

Q. Where?

A. In the deep mines of Lake Superior.

Q. Will you be kind enough to state what a fahrkunst is?

A. A fahrkunst is an arrangement for taking men in and out of a mine at the same time, in either direction. It consists of two parallel timbers, running in the shaft, or on one side of the shaft; and if the shaft is inclined at all, then these timbers run near the foot wall. They move regularly, by means of an arrangement of bobs at the top, which gives to them opposite motions, so that they move in parallel lines up and down, but in opposite directions, ten feet each way at a time. At every ten feet apart on these two timbers are steps like the steps of a carriage, and half way between these steps are small iron handles, arranged so that the men can take hold of them with two hands. A man can stand on one of these steps, and find five feet above that step an iron handle for his hand. Standing up on one such step, and holding on by the handle, the miner, when this beam begins to move, is lifted up, say ten feet. At the same time the opposite beam has come down ten feet, and he finds at the end of this stroke, just opposite to him, just such another step, and he steps over the distance of a few inches upon it. The next moment that beam goes up, and the one he is then on goes down, and comes opposite another step; he steps over again, and he is again lifted. At the same time, if he should miss one stroke, and should wait until the beam he stood on went down again, and then stepped across on the other beam, that would go down, and carry him down; so that, by simply stepping at the right moment, a miner goes up or down, whichever way he wants to go. At the moment of this stepping the whole machine is stationary, so that he does

not step upon any beam while it is in motion. The beams are running day and night, without regard to whether any body is going in or coming out. The number of miners that can go up and down at the same time is limited only by the strength of the machinery.

Q. Why cannot such a machine be constructed to be run from the bottom, and let these men go up? Do you see any difficulty about that?

A. It would be novel.

Q. Suppose you have a fahrkunst extending upward from the tunnel level, and men come in below on the tunnel level and go up to wherever they want to work. Can you see any practical difficulty about that?

A. The fahrkunst is usually operated from above. It is more convenient to pull a weight than to push it up. I think it is possible; and if you had power enough below, I think it would be worth trying.

Q. Now I want to ask you some few questions about ventilation. Don't you think that a deep tunnel connected with shafts, ventilates a mine, or assists greatly in ventilation?

A. Undoubtedly.

Mr. SUNDERLAND. I do not understand the answer to that question, Professor Raymond, because it is two questions really.

The WITNESS. Mr. Sutro asked me if I did not think a deep tunnel would thoroughly ventilate or assist in the ventilation of a mine. I said undoubtedly. I cannot say without any further qualification that a deep tunnel will thoroughly ventilate a mine. It depends upon the length. The principle upon which the power of a tunnel for ventilation can be ascertained is as mathematical as anything else in engineering. It is perfectly easy to decide which way the draught will be, and how strong it will be.

Q. Which way would the draught go, suppose the temperature at the bottom of the shaft is 100° or 110° , and it is say 65° at the top of the shaft and 65° at the mouth of the tunnel, which way would that draught go? We have

heard a great deal about it before, but I am not quite clear upon the question yet.

A. There is no doubt about the way in which it would go. It would invariably go up the shaft.

Q. Would not the hot air always rise in the shaft, where the temperature at the bottom of the shaft is much greater than it is at the top of the shaft?

A. Allow me to answer that very briefly in my own way. I can show you the whole theory of the matter in an instant. The air at the mouth of the tunnel is under the pressure of a column of air extending up to the top of the atmosphere, wherever that is. The air at the bottom of a shaft at the other end of the same tunnel is also under the pressure of a column of air which extends up to the top of the atmosphere. Now, the difference in weight of these two columns of air determines the way the draught will move. Outside and above the mouth of the shaft, and above that horizontal level in the atmosphere, the pressure is the same for both, but below that line you have out-doors a column leading down to the mouth of the tunnel, and in-doors or under ground a column leading down to the bottom of the shaft. If that is lighter than the other (it will be lighter, if considerably hotter,) then the draught will rise in the shaft with a power and speed determined by the difference in weight, with proper deductions for drag or friction of the air. In most mines, not exceeding 500 or 600 feet in depth in temperate climes, the tunnel draught is one way in winter and another way in summer, because the temperature in the mine is at one time in the year higher, and at another time lower, than the temperature out-doors. It is the temperature of the whole column in the mine, not of the bottom alone, that must be considered.

Q. Would it make any material difference, in working the mine, which way the draught went, up or down?

A. Yes, sir; it makes a difference. It is a great deal better not to have the draught of a mine, if you have all your arrangements to conduct it one way, so as to bring it as pure as possible to the parties of workmen—it is better not

to have it reversed, because if it be reversed it brings it first to the place where you want it to go last. If you have arranged your ventilation wisely, to begin with, it certainly cannot be the same thing to have it turned end for end. With a mine that is so deep as to give a difference of 20° between the bottom of the shaft and the summer atmosphere, the draught will always be one way. With a shaft 2,000 feet there never would be any such thing, in my opinion, as a draught down a shaft, and out of a tunnel.

Q. Has not a thorough ventilation a tendency to decrease the temperature?

A. There are two elements in the temperature inside of the mine. One is the temperature of the rock; the other is the increase of temperature produced by the exhalations of men and animals. The last element is very great in any actively worked mine, and that is the one most immediately and thoroughly reduced by good ventilation. The element of the temperature of the rock is reduced by ventilation and by working the mine to an important degree, but never is entirely taken away. Mines, however, without ventilation could not be worked nearly as deep as they are worked with good ventilation.

Q. Would you consider that, in working mines to a very great depth, it would be necessary to use compressed air?

A. Yes. I do not think that natural ventilation by any draught, produced merely by a difference in altitude of openings, would suffice for very great depth below the openings.

Q. Does it not take a great deal of power to compress air? Rather is there not a great deal of loss of power in compressing air?

The WITNESS. You mean in transmitting compressed air.

Mr. SUTRO. No, sir; in manufacturing compressed air?

A. The loss from the theoretical power is very large. If you use so many foot-pounds of steam power, you will find you do not get anywhere near that number of pounds of compressed air; but the loss in transmitting the compressed air is not large.

Q. Do you think it feasible to transmit compressed air four or five miles or even more?

A. Yes, sir, from the experiences of the Hoosac tunnel and the Mont Cenis, I should say that without any doubt.

Q. Don't you consider the loss very trifling?

A. It is not trifling, mechanically speaking, but practically speaking it is a loss that we can stand less than the loss by any other long transmission of power.

Q. Considering the power required for compressing air, would it not be a matter of high importance to have a cheap power to compress that air?

A. Of course.

Q. Such as could be obtained at the mouth of a tunnel, by water power?

A. It would be a matter of importance to have a cheap power.

Q. Now, to come back to the reduction of the temperature, do you consider that men can do much more work at a temperature say 75° than they could at 105° ?

A. Yes, sir; I think they could.

Q. Does it not become a very important item in mining economy to furnish such a temperature as will enable the men to do the most work?

A. Certainly.

Q. Would not the capacity of miners, at a temperature of 75° , as compared with 105° , be very much increased?

A. I think very much, decidedly.

Q. How much?

A. I cannot give you any estimate.

Q. Increase of 25 per cent.?

A. I could not say. I think there might be a gain of 25 per cent., if you combine the actual increase of a man's strength and power to work with the increase of his willingness to work. I have noticed myself that sometimes miners in very uncomfortable mines would not only, perhaps, be weaker actually for work, but they behaved weaker than they were.

Q. What do you know about the concentration of ores? Have you ever visited concentrating works?

A. Yes, sir.

Q. What is the first requisite in concentrating ores. Is it not water?

A. There are methods of concentration which do not employ any water; but all the complete concentration works which have been carried on successfully on a large scale have required water, and plenty of it.

Q. Is there a large space required for the purpose of concentration?

A. Yes, sir, in systematic concentration.

Q. Suppose you had to concentrate 1,000 tons a day, would there not be required an immense space of ground?

A. You would require a great deal of ground.

Q. And it would require considerable water?

A. Yes, sir.

Q. Would not you consider that the Sutro tunnel, going four miles in that country, and having lateral branches from it, three or four miles in length, would carry out a considerable amount of water?

A. I presume it would.

Q. Don't you think there would be water enough for concentrating purposes alone?

A. I have never made any estimate about the concentrating works requiring water for 1,000 tons a day, and I do not undertake to say.

Q. You cannot tell how much water there would be, but you can form some general idea, as a mining engineer of great experience, whether there would be a great amount of water.

A. I think, sir, I should not want to undertake to erect works for any such amount of ore, even arranging them in the best possible way to economize water, without from 500 to 1,000 inches of water.

Q. Don't you think there would be 7 square feet of water coming out of that tunnel?

A. That I could not answer.

Q. We have made provision for 20 square feet. We have made a drain of 20 square feet, and we expect it will be half full.

Mr. SUNDERLAND. You don't pretend to say you have any portion of that tunnel completed at all, do you?

Mr. SUTRO. We have some portion of it completed.

Mr. SUNDERLAND. How much?

Mr. SUTRO. I cannot tell you how many feet.

Mr. SUNDERLAND. I object to Mr. Sutro stating that he has made preparations in that tunnel for carrying out so much water, when it is perfectly well known there are not 60 feet of the tunnel completed.

Mr. SUTRO. I have a telegram here stating that 2,800 feet of the tunnel are completed.

Mr. SUNDERLAND. When he makes a statement which every body in that country knows is not the case, then he asks the witness a question based upon that statement.

Mr. SUTRO. I have asked the witness whether he does not think there will be 7 square feet of water flowing through that tunnel; and I have at the same time stated that we have made provision to carry off 20 square feet of water.

Mr. SUNDERLAND. You have not made any provision at all, because you have not anything but a little drift.

Mr. SUTRO. We have made provision to carry the whole tunnel through upon that scale, and there is provision made for 20 square feet of water to be carried through under the railroad track.

Mr. SUNDERLAND. I know very well you have not erected the tunnel at all.

Mr. SUTRO. I want to ask you, Professor Raymond, whether, with cheap coal or cheap firewood at the mouth of the tunnel, and the water issuing from the tunnel for concentrating purposes, reduction works could not be erected there which would supersede the reduction works that exist there now, without employing any water power at all—I mean for driving power?

A. If the coal is cheap enough.

Q. Suppose you get coal there for \$12 a ton?

A. Coal at \$12 a ton is about equal to wood at \$8 per cord.

Q. That is nut-pine wood. Take the Nevada wood. Is it not equal to wood at \$6?

A. You will have a great deal of waste in coal, if you have to bring it all the way from the Rocky Mountains. You had better say \$8. Saying \$8, I answer yes, sir. I think it would give an advantage to reduction works located at that point; but the decisive character of that, I judge, would depend on a great many other things. I have seen so many reduction works that "ought to supersede all others," broken down by entirely different causes than natural ones, that I cannot state whether it would or not.

Q. What I want to get at is this: Would not the water which the tunnel itself would furnish and the adaptability of the ground at the mouth of the tunnel be of such a character that the erection of very large concentrating works and steam machinery to propel the mills and concentrate the ores—would enable the company or the owners of the mills at that point to extract so much more from the ore as to increase the yield of the ores extensively?

A. If I understand the question, I think it might. It would facilitate the cheaper working of the ores and extraction of the precious metals with less handling, and it might secure a higher yield.

Q. I will ask you what is the yield returned to the mines, as far as your statistics go, and as far as your knowledge goes?

Mr. SUNDERLAND. I object to that, because it is irrelevant. The question is, if a question at all, to be considered by the committee: what is saved by the various processes used, not what the mine gives, because it can make no difference to anybody what proportion of the assay value is returned to the mines. It is not a matter of public interest, not a matter of interest to the Government how the products of the mines of the Comstock are divided between the owners of the mills and the owners of the mines.

Mr. SUTRO. I have always observed that the moment we touch upon the perquisites of the mines and the mills there which are owned by the Bank of California, Mr. Sunderland objects. It has been stated here over and over again, by every witness, that all the mining company gets is 65 per cent. and the mill company gets the other 35; and the mill company is so manipulated by the mining company, that the stockholder loses any benefit arising from either; and I think it, therefore, very important that the exact position of things should be ascertained, and why it is that there is this opposition to the construction of the tunnel. I believe I have asked that question before, and I do not see why the commissioner of mines and mining should not be asked the question how much is returned to the mining company.

By the CHAIRMAN, (Mr. NEGLEY :) Repeat your question, if you please, Mr. Sutro?

Mr. SUTRO. I asked Professor Raymond whether, according to the statements which have been furnished by him, the returns by the mills to the mines is not 65 per cent.?

Mr. SUNDERLAND. I object further to this question, unless Mr. Raymond knows what the returns are. If he has been informed, why that we have had a dozen times by different witnesses. If his statements are based only on information, then they are not testimony. If he knows what yield of the assay value is returned to the mines, then, if that is considered legitimate, why all right; but certainly if he only knows from information, he cannot testify. I still urge my former objection, that it makes no difference to anybody outside of the stockholders; but I believe Mr. Sutro does not pretend to be a stockholder in any mine on the Comstock.

Mr. SUTRO. Mr. Chairman, Mr. Raymond has received official statements from the different mining companies, which have been published.

Mr. SUNDERLAND. Please let the witness state that.

Mr. SUTRO. I want to ask the witness whether those statements do not show that the mines only get 65 per

cent. of the yield of the ores. I do not see that there is anything objectionable in asking that question. Every time a question of that kind is asked, Mr. Sunderland makes an objection.

The CHAIRMAN (Mr. NEGLEY.) If you will just confine yourself to the object you have stated. The purpose you have in making this inquiry is to show the economical working of the ores.

Mr. SUTRO. That is what I want to show. I was trying to reach that point when I was interrupted.

The CHAIRMAN (Mr. NEGLEY.) The witness can answer the direct question.

WITNESS. The question is, as I understand it—what, according to the statements furnished to me, the returns to the mining companies are; that is, how much they are?

Mr. SUTRO. Yes, sir.

WITNESS. The statement furnished to me in my official capacity was, that the mills guarantied to the mining companies 65 per cent.

Q. Do you know who gets the tailings—the other 35 per cent.?

A. That is not the same thing. The tailings are not necessarily the other 35 per cent.

Q. Who gets what remains from the tailings?

A. The mills, I believe; with the exception possibly of the battery slimes.

Q. What I want to get at is this: Suppose reduction works and concentrating works are erected upon a large scale, driven by steam, without any water power at all, and the water issuing through that tunnel is used for concentrating purposes, could not the tunnel company afford to pay 65 per cent. to the mining company right at the mine to take the ore and work it and make money out of it—say the average ore to be \$30 and upward?

WITNESS. With the tunnel in operation, and a complete system of concentrating works in operation, I believe that the company could pay 65 per cent. on \$30 ore and clear itself. I do not think there would be a large margin of

profit, however, but it leaves, according to my figuring, about \$7 margin per ton.

Q. That is not employing water power at all?

A. I am not employing water for running the concentrating works. I want to explain that answer. I do not think it fair that it should stand in that way. It turns entirely on the fact that by concentration and by the treatment there, not by any means that you will get all the silver out of that ton of ore that you work in the mill; but that you may reduce a large quantity of poor stuff into one ton, and you will save the cost of milling in the pans on the remainder, and by handling so much less at the last—in the last operation—even if you do not make a close metallurgical run, you save so much expense in treating the large quantity, that you are able to make a large allowance.

Q. Suppose the ore, Mr. Raymond, would work \$35 or \$40, there would be a handsome profit, would there not?

A. Those estimates of mine are not to be regarded as professional estimates, on which I propose to stake anything.

Q. So far as you can arrive at it at all by making a few figures, that is your conclusion?

A. My impression is it might pay, if that ore were free of all mining cost at the foot of the shaft. Then the tunnel company would be enabled to offer to pay the mining company 65 per cent., and take the ore at their mine and clear itself on \$30 rock.

Mr. SUNDERLAND. What do you mean by \$30 ore? I do not understand.

Mr. SUTRO. Not the assay value; the yield—ore that will yield \$30.

Mr. SUNDERLAND to witness. Is that what you understand by it?

The WITNESS. Yes; the yield it will make.

Mr. SUTRO. Yes, that is the way I thought it was understood; that is the ordinary value of milling rock.

Mr. SUNDERLAND. I only want to understand.

Q. Suppose the tunnel company would pay the mining company 65 per cent. right at the mines, transport the ore out, and reduce that ore at the mouth of the tunnel, and make a profitable operation out of any rock over \$30, would not that save the mining company the whole expense of transporting and milling?

A. Yes, sir; on low-grade ores it would.

Q. Would it not on any kind of ores?

A. No, sir; not on first-class ores, because on those they get more than 65 per cent.

Q. Smelting ores, you mean? I mean the average of the ores that come from the Comstock lode—not roasting or smelting ores.

A. You can see exactly what it would save as well as I can.

Mr. SUTRO. According to this, there would be a saving of \$12 a ton—\$12,000 a day; and 365 times that would effect a saving of \$4,380,000 to the mining company.

WITNESS. That is a business proposition. I do not think the matter is quite as simple as that. That seems true as a comparison between the system by which they never get more than 65 per cent. and the system by which you should pay them 65 per cent. down; but I suppose that the former system might be ameliorated so that the saving would not be so great.

Q. Taking these statements for granted, that they get 65 per cent., which has been shown here over and over again by the commissioners——

Mr. SUNDERLAND. That has not been shown at all, but directly the contrary.

Mr. SUTRO. You have tried hard to show it was not, but I do not think any one has denied it.

Q. I want to ask you a few questions about the rocks along the line of the Carson river. What are those rocks?

A. I have never made any special examination of that locality. I suppose they are volcanic and igneous rocks.

Q. Are they of a character so as to let water through readily?

A. I do not think they would pass water through as

readily as stratified rocks, provided the water in stratified rocks follows on the line of cleavage; any rock that is cleaved throughout any particular portion may allow water to pass in that direction quite easily, and the rocks that are crystallized, as a usual thing, do not allow water to pass except through fissures. There are a great many fissures in the trachyte, but they are irregular; they do not run in any one direction.

Q. Do not they form a homogeneous mass generally?

A. On a great scale they may be called homogeneous. The trachyte itself consists of a homogeneous mass, containing small crystals of feldspar.

Q. Supposing the trachyte becomes once soaked with water, would it allow any water to pass through it?

A. I do not think it would to any practical extent. I do not exactly know what you are driving at; most rocks allow water in small quantities to pass through them.

Q. I will explain to you why I put this question. It has been proposed to make a dam across the Carson river. It is not a necessity at all for the tunnel, but we have had a great many arguments about that dam, and some witnesses have testified that the rocks in that country are of a sandy character—loose character—and that water will go through them like a sieve. That is the reason I asked you, as a geologist and as a mining engineer, whether there are any such rocks in that neighborhood that have any such characteristics as to allow water to go through them like a sieve.

A. There is a popular notion in the west, that a great many streams sink and disappear on account of the porous character of the rock and the soil. I think that is a mistake. I think that the disappearance of the water in our western streams is mainly by evaporation; but there is a certain percolation of water through the sandy soil and the surface for a few feet in the valleys, so that the stream will work along under the sand for some distance after it seems to disappear. That don't go very deep, in my opinion however.

Q. Would there be much percolation in a rocky gorge which is formed by the Carson river?

A. I should think not.

Q. Would the water be lost there, except by evaporation?

A. I should think not.

Q. That has been given here by General Foster at 44 inches per annum. Would it not be about that?

A. I do not know; probably that is correct.

Q. Would you consider that, with a royalty secured to this tunnel company through contracts and by law of Congress, that security would be sufficient for a loan of \$3,000,000?

Mr. SUNDERLAND. I object to that.

WITNESS. I do not know anything about the royalty that is secured.

Mr. SUTRO. There is a royalty tax of \$2 upon every ton of ore?

A. I know that, but I do not understand the bearing of the question as a question for a mining engineer. If you want to ask me whether I think the Comstock mines will yield a certain sum before they give out at a certain rate per annum, I can tell you.

Q. Suppose that for every ton of ore in the Comstock lode \$2 a ton is paid there as long as the mines can be worked, would that \$2 per ton be ample security for a loan of \$3,000,000?

A. Yes, sir.

By the CHAIRMAN, (Mr. NEGLEY:)

Please tell us as to the richness and value of those mines to be reached by the proposed tunnel—do you think the Government will be justified in making any considerable expenditure to ascertain it?

A. I do not exactly feel called upon to say what the Government will be justified in doing; that is a question of legislation. You ask me if the Government will be justified in making any considerable expenditure. I will admit that—

Q. I put the question because you are an officer of the Government.

A. I am an officer of the Government, but I do not belong to that department that decides the policy of its legislation.

Q. It is not a question of legislation; it is a question of policy. The question is whether the Government would be justifiable in any considerable expenditure to determine these geological facts as to the richness and the extent of the Comstock lode.

A. Well, the determination would be of great value, and it is a matter that would be worth considerable expenditure to find out. The question whether or not that expenditure should be made, or whether the Government would be justifiable in making it, it is a question which involves the whole present relation of those mines to the Government, and that is a pretty tangled one. I can hardly answer it. I will say frankly, that if the proposition were to run a tunnel at a cost of \$3,000,000, out and out, to the Government; and with no other return to the Government or anybody else than the ascertaining of these facts, it would be a very expensive way to get the information. If this was all there was of it, it would be a proposition I do not suppose anybody would make.

Q. I have not stated an amount; my inquiry was whether it would justify any considerable amount of expenditure.

A. Yes, sir. The Government is said to have spent nearly a half million dollars already in the surveys and publications of Mr. King, which are largely devoted to that lode. I consider that was justifiable.

Q. Would not the economy, in time, as well as the demonstration of the fact, be of great value to the Government and to the nation?

A. Yes, it would. I consider that the profit to the country in some such cases is an entirely separate proposition from the profit to individuals. The country may profit by a course which is not to the immediate profit of individuals. It frequently has happened, and I suppose will happen under our present system over and over again, that

individuals go on the public lands and open mines, and consulting only their own immediate profit, not having purchased those mines of the Government, and not being permanently located there, make a point of skimming the cream off of the mines, making a great deal of profit for the time being, and then probably abandoning the mines, entirely. The country of course loses whenever a mine has been skimmed in that way, by the very fact that the average value has been reduced by taking out the richest portion of the mines. That is what is called piratical mining. That is the difference between our system of mining and the system of mining in all other countries, where their forms of government permit more rigid governmental control. There the Government takes the same ground in regard to mines that it does in regard to the timber; still, more with regard to mining; that is, that the mineral resources must not be wasted for the sake of present dividends, because they belong to posterity as well as to the present generation, and it is the duty of the Government to nurse that industry in such a way as to make it last as long as possible to support the people and be a source of power and wealth to the country. It is perfectly easy, by a system of piratical mining, to render a mining district comparatively useless for generations to come. With regard to agricultural lands, some farmers out in the Middle States and far West get great farms and work them as hard as they can to make great profits out of them, then they leave the lands perfectly worn out. But there is a difference between the agricultural and mineral lands. The agricultural lands may recover, but the mineral lands never.

Q. As a general thing, does not private enterprise and capital shrink from such large undertakings, as would demonstrate the richness of mineral lodes surrounded by such great natural difficulties?

A. In this country they undoubtedly have done so. Such enterprises are novel in this country, and of course capital has shrunk from them. There needs to be more stability of general conditions than we have as yet in our

western country, for private capital to be willing to go ahead in such a manner. It is not like a settled country, where all rights are perfectly well determined and perfectly secured, and where people can go into any enterprise with perfect good faith, knowing they will be sustained throughout. Men of property and capital investing in any long and doubtful enterprise in this country, are exposed to all sorts of risk in our mining regions, arising from insecurity of title, and from the character of legislation, &c. If Mr. Sutro's tunnel, for instance, had been begun when it was first talked about, and been going on all this time, the whole mining laws of the country would have been changed two or three times in that period, and the ownership of all the mines probably have changed innumerable times; and all those features of change would have deprived enterprises of that kind of a character for stability which they need, that capital may have confidence and trust in them.

MR. SUTRO. Do I understand you that, if the Sutro tunnel had been started without any authority from Congress——

WITNESS. I do not mean to say that it would have had any effect upon the Sutro tunnel. I merely refer to the fact, that since it has been talked about there have been changes in the local laws and general laws, private ownership, and everything surrounding the case, and that makes it a very different sort of proposition to go to private capital, from what it would be in an older country. In other words, if you had not anything more stable than these local laws——

THE CHAIRMAN, (MR. NEGLEY.) Deep mining is too limited in the California auriferous mountains to determine satisfactorily the richness of the lodes at the same depth at which they are reached and worked in Europe?

A. We have mines as deep as 1,200 to 1,400 feet in the California auriferous belt.

Q. Consequently the richness of the lode at the depth worked with profit in mines in Europe remains yet a problem?

A. It is not known yet.

Q. To attain that information, it would justify Government in making an exploration, would it not?

A. You could not obtain information of the richness of any one vein by running a tunnel in any other vein.

Q. When you have so important a lode as the Comstock lode?

A. With regard to the Comstock lode, that is an exception to all the lodes in this country, and of almost all the lodes known in history. That makes it a very different matter. Where one vein has produced as many millions of dollars as the Comstock has, it becomes a matter of national interest—equal in importance, I may say, almost to any hundred mines in the country. Take put a very few exceptions, and it will equal in importance any one hundred mines anywhere.

Q. Is not the yield in the Comstock lode equal in profitability almost to that of all the Mexican mines together?

A. Not in profitability. The aggregate amount has been very large, but the aggregate profit has been small.

Q. I do not mean to the owners, but I mean in addition to the treasure of the country. I do not mean the profit to the stockholders, but I mean so far as the yield in quantity of treasure extracted is concerned.

A. No, sir; it would not come up to the aggregate yield of the Mexican mines, because there was a time when they were enormously productive. I think it excels any one of them as far as I recollect, and it is probably greater than the yield of all the silver mines of Saxony, which made the Saxon royal family the richest in Europe.

Mr. SUTRO. The annual yield of the Mexican mines is twenty-five millions.

WITNESS. If that be so, then the annual yield of the Comstock is not so great.

Mr. SUTRO. The statistics, as given by Humboldt—and he is the only authority we have on that, and an acknowledged authority—show that between 1795 and 1810 the mines of Mexico were in their most flourishing condition,

and the average yield in those years was \$21,000,000 per annum; and that is the highest yield that has ever taken place in Mexico, until within a very late period they have somewhat run over that.

Q. You could not say that the Comstock produces more than all the Mexican mines?

A. No, sir.

The examination in chief being concluded, the committee adjourned till Monday, the 25th instant.

HEARING MONDAY, MARCH 25TH.

Committee met pursuant to adjournment.

Cross-examination of R. W. Raymond was commenced.

By Mr. SUNDERLAND:

Q. I understood you to state the other night that you had received your mining education principally in Europe. Is that so?

A. My professional school studies were in Europe.

Q. That is what I meant. In what country did you first see tunnels run into mines?

A. In Europe.

Q. In what part of Europe?

A. Germany.

Q. For what object, principally, were those tunnels run in Germany?

A. I suppose they were principally run for drainage and water power.

Q. Are not the circumstances of the Comstock lode very different from those surrounding any mine in Germany where you have seen tunnels run?

A. In some respects, yes.

Q. Is not the ground much dryer at the Comstock than in those mines in Germany?

A. I presume it is.

Q. Do you know what the fall of water is there per annum?

A. No, sir.

Q. Do you know what quantity of water flows through any one of those mines where there is a deep tunnel—abroad, I am talking about now?

A. I could not give it to you exactly. I can say in general terms, if you want that.

Q. As near as you can give it.

A. At one of the deep tunnels in the Harz mountains

there is a sufficient quantity of water for navigation; they use it as a canal.

Q. Where is that used for water power?

A. It is used for water power at Freiberg.

A. Is it used at the mouth of the tunnel or in the mines?

A. It is used at the mouth of the tunnel, wherever there is sufficient fall.

Q. What fall is there from the mouth of the tunnel to where it is used near its mouth?

A. I do not refer now to any particular mine.

Q. Do you know whether there is such a constancy or regularity of flow of water in the Comstock as to rely upon the water for power anywhere in the mine?

A. I have inferred from some reports of the Comstock that you could rely, at least, upon the minimum that is mentioned.

Q. Do you know that in the Comstock the water is very irregular; that a mine may be overflowed in the winter or summer, and in less than six months be absolutely dry?

A. Yes, that is the case, with the exception of the term "absolutely."

Q. What qualification would you make to the term "absolutely?"

A. Well, I would say that there may be absolutely dry places in some portions of the mines, while the whole of the mines might not be.

Q. Do you know whether there is any fall anywhere in the Comstock to-day, where you could use the water in the mine for propelling power, or for any power?

A. I believe they bring the water from as low as the 600-foot level of the Comstock; but I am not aware that they have any available tunnels lower than that, and consequently there will be no fall where they could use the water.

Q. How often have you visited the Comstock?

A. I think two or three times—twice.

Q. How long a time have you ever spent in examination of the mines upon the Comstock?

A. A very few days.

Q. What proportion of the mines did you visit while you were there?

A. I visited the principal mines that were producing ore.

Q. When were you there the last time?

A. The last time, I think, was in 1869.

Q. What advantages, in your opinion, to the Comstock, would the running of the Sutro tunnel be?

A. I believe that there would be positive advantage in the draining; positive advantage in the procuring of power in the mines; positive advantage in the ventilation; and an advantage in transportation.

Q. Do you know what proportion the waste, or unproductive rocks and earth, taken out of the Comstock, bears to the gold-bearing quartz? I mean the amount taken out that is not used for filling in.

A. I know nothing more about it than the statement made by one of the superintendents, in the report of the commissioners, which was, that there was an equal amount. I do not think there ought to be so much.

Q. You say there will be an advantage in the cost of transportation. Do you know what it costs to transport over there now to the mills?

A. Not of my own knowledge.

Q. Do you know what it costs under the act of Congress, giving Mr. Sutro this franchise, to transport ore to the mouth of the tunnel?

Mr. SUTRO. I object to the question; that is not a true statement of the fact. The act of Congress does not give us the right to transport ore through there at any given rate.

WITNESS. I think I can answer the question. I think I know what it would cost to transport ore to the mouth of the tunnel——

Mr. SUNDERLAND. What it will cost the mines, not what it will cost Mr. Sutro.

Mr. SUTRO. That's entirely voluntary, under the act of

Congress, to be governed by such contracts as may be made.

WITNESS. I do not know anything about the act of Congress. I am not saying what advantage it would be to Mr. Sutro under any contract; but I can estimate what the cost of the transportation will be.

Q. The cost is 25 cents per ton per mile—the same as it costs for the transportation of debris and waste rock or earth; then, if the waste is equal to the ore, it will cost how much for each ton of earth taken out? What would be the average distance from all the mines to the mouth of the tunnel?

A. If the managers of the mines are foolish enough to send out as much waste as they do ore, and pay 25 cents a ton for taking it through the tunnel—it will cost 50 cents a ton per mile.

Q. What would be the average distance now to transport the ore from each one of the mines—on the Comstock to the mouth of the tunnel, or to a point where mills could be erected, beyond the mouth of the tunnel?

A. I suppose it might be four or five miles.

Q. Do you know the length of the tunnel?

A. I know it from these reports.

Q. What is the length of the tunnel?

A. It is 18,000 feet nearly.

Q. The commissioners give the average distance, I believe, at five miles.

WITNESS. Very well, sir.

Q. Now, then, how do you make any advantage to the Comstock in transportation of ore from the mine, when, according to your estimate, it will cost \$2 50 for each ton of ore run out through the tunnel?

A. That requires a very simple answer. I did not say anything about 25 cents per ton per mile. I am not here to testify anything about Mr. Sutro's contract.

MR. SUNDERLAND. I will read you so much of the contract as fixes it:

"Also during the time when said party of the second part shall use said tunnels or drifts as means of transportation, as hereinbefore contracted for, the party of the second part will pay to the parties of the first part, for each ton of ore, rock, earth, or debris removed from the point hereinbefore designated, to or beyond the mouth of the tunnel, as the case may be, the sum of twenty-five cents per mile from the place of removing it to the place of discharging it, and at the same rate for all material conveyed from the mouth of the tunnel to said point of connection heretofore described—forty cubic feet of timber, or twenty-two hundred and forty pounds of rock, ore, or other material being considered a ton."

That is Mr. Sutro's contract.

Mr. SUTRO. That is a matter of option entirely—the running out of ore through the tunnel under that contract. That is the maximum charge that was made in the contract between the Mining Companies and the Sutro Tunnel Company. It is not obligatory upon them to pay that rate or use the tunnel. It is a matter of choice.

By the CHAIRMAN, (Mr. NEGLEY.) The witness——

Mr. SUTRO. One cent a mile only may be charged under that act.

Mr. SUNDERLAND. Nobody ever heard of a monopoly, such as the Sutro tunnel will be, charging less than the law allows.

The CHAIRMAN, (Mr. NEGLEY.) Is it a matter of contract?

Mr. SUTRO. Yes, sir.

The CHAIRMAN, (Mr. NEGLEY.) Then it cannot be a monopoly.

Mr. SUNDERLAND. Cannot a monopoly be made out of a contract?

The CHAIRMAN, (Mr. NEGLEY.) There is nothing there to compel the company to send ore through there, is there?

Mr. SUTRO. It is a matter of choice whether they send ore through there or not. They are not compelled to send one cent's worth through.

WITNESS. The advantage in transportation, in my opinion, would arise in this way: I believe the proprietors of the mines at that time, if they found they could send their ore in that way cheaper than the other way, would do it; and the tunnel company, rather than transport no ore, would take it at such price as would give them a fair profit.

I do not figure on 25 cents per ton, nor do I figure on sending through this tunnel all the waste; and the reason why I leave out the waste is very simple. The transportation through the tunnel under such an arrangement would be the transportation out of the mine plus the transportation to the mill, if the mill was at the mouth of the tunnel: therefore sending the waste out through the tunnel would be like sending all the waste rock to the mill, which they do not do now.

Q. Why do they not?

A. They do not choose to pay the expense of hauling, because it is cheaper to leave it near the mouth of the shaft.

Q. Would it not be much cheaper to raise waste rock, or whatever is necessary to be raised, and deposit it on the surface, near the top, than to run it out?

A. It might be cheaper under certain circumstances—in regard to such material as did not have to be subsequently hauled or handled.

Q. Don't you know all the vacant spaces made by mining are filled up now with waste?

A. No, sir; I am not aware of that. My personal observation is exactly the contrary; but my personal observation is now several years old; and I have been assured very recently, by gentlemen engaged in mining there, that that is the case. I am not personally aware of it. On their authority I accept the fact.

Q. In what mines did you see them put waste rock when you were there?

A. I saw large spaces in the "Kentuck" and "Crown Point."

Q. Do you know whether waste was taken out of those spaces worked out, or whether it was all ore?

A. I think it was all ore.

Q. Then where would you get your waste from to fill up those vacant spaces? Would you raise it in the mine, wheel it to a distant part of the shaft, or lower it from above?

A. If I had the surplus of waste in the mine, and I was expecting to have to hoist it clear out, I would hoist it part of the way out, and put it in these spaces.

Q. Don't you think it is much cheaper to raise an incline or winze shaft into barren rock, above where the vacant space is, and throw it down the winze or incline?

A. I could not answer a general question like that. It would *not* be, as a general rule, cheaper; it might in some particular case.

Q. To what extent would the Comstock be benefited in the way of drainage?

A. In the first place, by making all pumping machinery unnecessary above the tunnel level.

Q. Would it exceed the present cost of pumping?

WITNESS. What would?

Q. Would the advantage of the Sutro tunnel to the Comstock; in the way of drainage, exceed the present cost of pumping?

A. In that item it would be just equal to the present cost of pumping, because it would save the present cost of pumping.

Q. Would it exceed?

A. If you were spending a certain amount for pumping, and you saved that money, you cannot save more than that in that item; but there would be incidental benefits, in regard to the drainage, that would make an additional advantage.

Q. What would they be?

A. First would be the obtaining of a head for water power.

Q. In the mine?

A. Yes, sir.

Q. Whereabouts in the Comstock would you have any head for water power?

A. Wherever you could get a shaft to the tunnel.

Q. Suppose there was no water in that shaft?

A. There would be.

Q. Do you know that fact?

A. I am very positive of it.

Q. In every shaft upon the Comstock?

A. There may be one or two exceptions, but in the majority of shafts in the Comstock I believe there would be water enough to use.

Q. What fall would that water have?

A. That would depend upon the level it came from; and the testimony in regard to the Comstock at the present time is, that most of the water comes from the upper 600, feet, and so has a fall of say 1,500 feet.

Q. How deep is the tunnel below the mouth of the shaft sunk upon the Comstock?

A. I suppose it is 1,890 feet below.

Q. Below what shaft?

A. Below the Gould and Curry. I do not remember the figures exactly.

Q. You talk about having 1,500 feet of fall?

A. That is a very general expression. I do not mean the exact fall, because I have just stated that would depend on where the water was brought in. If you bring the water in from outside, for instance, at the top of the shaft, there will be a head equal to the whole depth of the shaft to the tunnel level.

Q. You gave quite a lengthy description the other evening of the mode of raising ore by lowering water of greater weight than the ore that was raised up. Will you advise us of any such means on the Comstock for raising ore?

A. Not for a long shaft, because the movement is slow.

Q. I am talking now about raising the ore. I say for raising ore in the present shafts on the Comstock. Would you advise the abandonment of the present mode of raising for the introduction of any other, if it is to be raised?

A. No, sir; I did not intend to recommend the water hoist for deep shafts and long passages, because it is, as I say, slow.

Q. Then what application has it to the Comstock?

A. It was asked me whether you could raise men in that way from the tunnel.

Q. First, your description was the mode of raising ore?

A. I illustrated that proposition as to whether, with the water and a head, weights could be raised; and the question, as I recollect it now, was put to me in regard to men. I described the arrangement for raising water, hoisting ore and coal to the top of the furnaces. It may be you got the impression that I referred to the hoisting of ore above the tunnel level.

Q. Do you or do you not mean to advise the adoption of any such mode of raising ore upon the Comstock?

A. No, I do not recommend it for raising ore from the Comstock. Above the tunnel it would not be necessary, and below the tunnel it would not be possible.

Q. Then you described a mode of raising and lowering men, which I believe is called in Germany, so far as I can pronounce it, *fahrkunst*; would you advise the adoption of any such mode on the Comstock?

A. Yes, sir.

Q. Why?

A. Because it is safer, although a more expensive mode.

Q. Safer?

A. Yes, sir; in my opinion.

Q. That would occupy what space in the shaft?

A. It would occupy one compartment.

Q. How long does it take a man to ascend 1,800 feet?

A. I don't remember exactly the speed with which that goes—(witness proceeded to calculate the time, and after doing so said,) about 12 minutes.

Q. Does it take the same time to go down?

A. Yes, sir.

Q. Most work done in the Comstock is done in 10-hour shifts: the men coming up at 11 o'clock, and the new shift going down at 1 o'clock in the day, and the same hours at night. If you were to have all the miners at one time coming down, would it be economy, then, to have all the weight on those timbers that go up?

A. If you will give me the number of men, I will try to tell you.

Q. There are about 300 or 400 miners.

A. You would not put 300 or 400 miners on the fahrkunst at once. The simple necessity in that case would be, to arrange the shifts so that they would not all come out and all go in at the same time.

Q. Well, would not the weight——

A. The weight is just the same going up or down.

Q. What power is there required to work that machinery?

A. I could not tell you without examining notes. This whole matter of the fahrkunst has nothing to do with the question of the tunnel. It may or may not be advisable to use it in the Comstock.

Q. I will get your opinion of the probability of all the principal shafts that are now being worked in the Comstock getting below the tunnel level before the tunnel reaches Comstock?

A. I am not certain whether the shafts that are expected to the tunnel level within the next year or two are all that are being worked, and therefore I am not able to answer that question categorically, but no doubt some of those shafts will be below the tunnel level before the tunnel is there; and I am informed one of them is nearly or quite at the tunnel level now.

Q. Do you know how long it has been since the Sutro tunnel was commenced?

A. No, sir; not of my own knowledge. I have no personal knowledge that it is commenced; I never saw it.

Q. You have never been in the Sutro tunnel?

A. Never.

Q. In one of your reports you speak of several veins having been cut by the Sutro tunnel. What authority had you for saying that?

A. I inspected a series of specimens taken out at intervals every few feet in the tunnel, and I judge from the material, of which I found some of the specimens.

Q. How do you know that those specimens came from the tunnel?

A. I have no reason to doubt that they did.

Q. You do not know it of your own personal knowledge?

A. I have no personal knowledge on the subject.

Q. Do you think that if there had been any veins cut by the tunnel, that had the appearance of being metal-bearing, that they would have lain until this time without being prospected?

A. I have no knowledge one way or the other about that; but think it quite likely they would have been prospected.

Q. What was the material of the vein matter that you saw?

A. Silicious material.

Q. If it had not been raining, I would have brought some maps here to show the working of the lower portions of the Comstock. Have you examined all those maps published by Mr. King?

A. Yes, sir; in King's atlas.

Q. Do you think you could have ventilated, by means of this tunnel, the whole Comstock?

WITNESS. All the drifts and works?

MR. SUNDERLAND. Yes, sir.

WITNESS. No, sir.

Q. Would not the ventilation be confined to the single passage between the tunnel and each shaft?

A. The inner end of the tunnel.

Q. Terminating at the Comstock, from that point through the drift that may run from there to each shaft—the bottom of each shaft?

A. That would be the only passage on that level, I suppose.

Q. To what distance on either side that passage—that drift—would the effect of the circulation of the air be felt?

A. If that drift is run in the rock, and the rock is all solid at the tunnel level, if I understand you, of course there is no question of ventilation in a solid rock; and if there are other passages leading out of that drift to the different mines, or to explore on that level, you can carry

the air by splitting the current, through every one of them.

Q. Where would you split the current?

A. Wherever you wanted to split it.

Q. In the tunnel?

A. In the drift.

Q. In the drift after leaving the main tunnel?

A. Yes, sir. That is the question to be determined entirely by the size of the air passages and the drag of the air.

Q. Suppose the tunnel were completed, and in going south it commenced at the Savage mine, next south of that is the Norcross, and you take a portion of the air into the Norcross, and then into the Chollar, and then in the Bullion, and then in the Gold Hill mines, would there be anything left to take into the Yellow Jacket, the Kentuck, and Crown Point, and Belcher?

A. That is too indefinite a question for me to answer. I can give you a general idea of the amount of air going into the tunnel, and you can divide it up for yourself.

Q. I want you to divide it up. Tell me how many cubic feet are required in that mine?

A. It depends entirely upon the air they want to ventilate. It is not necessary for them to ventilate all their works. It is only necessary for them to ventilate the points where the men are at work.

Q. That I understand. Therefore it depends on the positions of the men, and the number of men, and the amount of air they want. Now, do you think that sufficient air could be carried through that tunnel to ventilate these different mines at the different points where the men are at work?

A. Men are at work sometimes only on one level, but generally they are at work on several levels, where mining is carried on properly. The only analogy by which I can answer that question is that of the ventilation in coal mines and ventilation in deep mines in Europe. According to that analogy I should be led to say at once that it could be done, but this is an operation so much larger in

some respects, notably in height of shaft, &c., and the conditions of what we call the drag or friction of the air—so different, that I do not think I could answer the question directly. Indeed, I think the tunnel might not be sufficient at all times of the year, and perhaps not at any time of the year, to ventilate of itself, without assistance, all parts of the mine.

Q. Do you know what size they propose to make the tunnel?

A. It is proposed, I believe, to make it twelve by thirteen and fourteen.

Mr. SUNDERLAND. The contract says, article 6, that,

"The dimensions of said tunnel shall not be less than seven feet in height in the clear, and eight feet in the clear in width."

Mr. SUTRO. Mr. Chairman, I wish to state, right here, that there is no provision in that contract that operates so as to prevent the tunnel being made any larger than 7 or 8 feet; we are making it 12 by 14 feet.

Mr. SUNDERLAND. I do not know whether you are making a tunnel at all.

WITNESS. I do not make my calculations on 6 by 8. I make them on 12 by 14.

Q. The bill that is now before Congress, and which is referred to this committee, calls for 100 square feet?

WITNESS. It is a mere calculation. My calculation was 150 feet section.

Q. Now, when these mines get below the tunnel level, will the air going in through the tunnel go downward into the mines?

A. No, sir.

Q. Then you must apply artificial means—use artificial means to force the air down?

A. Yes, sir. If the mines above at that time are not occupied, and you have a clear shaft down to the tunnel level of 1,800 feet, for instance, you can produce for a few hundred feet, by a simple direction of the air currents, a downward and upward draught, ventilation of the works below the tunnel level.

Q. In working a mine, is it necessary to have your drifts very crooked through which you have got to have your air go to the points where the men are at work?

A. I only speak of the supposition that in some particular mine, as for instance the Yellow Jacket, which I have been informed is now down nearly or quite to the tunnel level, all the ore above that level should be extracted before the tunnel reaches it, so that the mine should be unoccupied. In that case it would be possible to utilize the draught of air in such a way as to ventilate to a considerable extent the workings below the tunnel level. Of course this could not be done *ad infinitum*, for there would come a time when the drag of the air would be so great as to stagnate the ventilation.

Q. In answer to a question the other evening by Mr. Sutro you stated that the mines in Europe were worked with intelligence. I will get you to state whether the mines on the Comstock are now worked with intelligence, so far as you know?

A. I do not remember of stating that to Mr. Sutro as a sweeping proposition. There are badly worked mines in Europe as well as in this country, but the mines that are under government control in Europe, or worked by government engineers, are worked with scientific applications; but there are in a great many cases abroad, just such rude methods of mining as you will find in a great many of our districts at home. If you ask me whether the Comstock is worked with intelligence, as a general proposition, I will say yes.

Q. In connection with that, when your opinion was asked upon the expenditure by the Government of \$3,000,000 for the running of this tunnel, what opinion did you give, if any?

A. I declined giving any opinion as to any action of the Government.

Q. I understood you to say that Government had expended about \$500,000 on Mr. King's work, which was mostly devoted to the Comstock?

A. I think I said largely devoted to the Comstock.

Q. That was, perhaps, the word. Now, I will get you to state whether the description of the mode of mining upon the Comstock, and of the machinery used upon the mines in hoisting up, and the machinery used in the mills, and the mode and manner of reduction, were not given for the benefit of others, and not for the people on the Comstock?

A. I suppose it was given for the benefit of what is called "science," which is the combined experience in that matter.

Q. Is the publication of that book of any benefit to the people along the Comstock? Does it give anything beyond what is known to those who are there?

A. I do not suppose it gives any information beyond what the leading superintendents of the Comstock know; but I regard it as valuable even to them. It puts in permanent form those things which in five years from now they or their successors might not otherwise know. There were, for instance, a great many mining operations on the Comstock in the early days, concerning which it would be very important to have such careful and detailed information as Mr. King gives concerning the operations of a year or two ago. It was, as I understand it, in consequence of that experience and the experience of that inconvenience that has been spoken of, that the companies adopted this system of making complete maps, giving a full description of their works.

Q. Mr. King's atlas, in his description of the mines and mode of milling, was simply taken from the maps made by the surveyors of the Comstock; the mode of reduction simply from the mill men; and the description of the mills and the machinery used in the mills from what is there now?

A. Of course, it is a great deal more valuable to us outside of Comstock than it is to people who knew it before. If I may be allowed to add a word, I made that mere allusion in connection with the question whether it was wise to expend money simply to discover facts in geology and min-

ing. I said that there might be expenditures made which might be justifiable. I was not prepared to say that an expenditure of \$3,000,000, merely to discover a fact in geology, was justifiable; but yet I do justify the expenditure by the Government of several hundred thousand dollars—if so much, and that is the common report—for the preparation of such a work as Mr. King's. I am thoroughly in favor of it, and that remark was merely thrown out to show I do believe in the expenditure of money for such a purpose, though I explicitly stated I would not justify an expenditure of \$3,000,000 for that alone.

Q. Would you run a tunnel or advise the running of a tunnel for exploration alone?

A. No, sir; I am opposed in opinion to the running of extensive deep cross tunnels, exclusively as works of exploration or as primary works, before mines have been developed.

Q. I believe you stated, in answer to some question, that you thought the running of this tunnel would induce capital to be invested in the mines?

A. I stated that as the result of several questions leading up to it, if I remember rightly; and the conclusion is qualified somewhat by the answers that precede it. It would in my opinion tend to induce what I regard as a more permanent system of mining in that locality, and if it demonstrated, according to the questions put to me, the continuance and value of the lode in depth, it would tend to inspire confidence on the part of capitalists in mining operations in our western districts. This would not be actual demonstration of the value of the other mines; but it would have a tendency on the minds of capitalists in that direction, while it might actually demonstrate another thing, viz: the best way to work the mines with permanent success.

Q. But suppose the present companies working upon the Comstock should be from two to five hundred feet below the tunnel when it reached the lode, would the running of the tunnel demonstrate the richness of the mines?

A. In that case the running of the tunnel would demonstrate no more than it would show, unless explorations in the drift from the tunnel proved something more: for the drift might prove a great deal more than the shaft.

Q. How so?

A. Because the shaft goes through the vein, and only in one vertical line, but does not prove the character at any given depth, except of the small area it passes through. If the shafts are down, and the proprietors of the mines have extended a drift at the tunnel level, the whole length of the lode, before the tunnel gets there, then the tunnel cannot prove anything additional to that drift.

Q. From what you have seen on the Comstock, are not drifts run every 100 feet from the shaft that goes down?

A. It is not the universal practice there, but they are, I believe, where they have reason to expect any ore. I have noticed in some instances in the mines that they skip spaces. A single drift, which in ordinary mines would prospect the whole width of the vein, does not by any means do this adequately upon the Comstock—upon many portions of the Comstock. You are well aware, as well as everybody who has been on the Comstock; that that vein differs from every other vein in the matter of exploration by the fact of its great width, so that a single drift in either direction does not prospect the whole width of the vein.

Q. Then could the Sutro tunnel, running through the Comstock, possibly demonstrate anything one way or the other?

A. The Sutro tunnel, running through the Comstock, would not demonstrate anything more than it showed.

Q. Then, if these shafts—the main shafts—are down to the tunnel level before the tunnel reaches there, would it not be much cheaper to run drifts between the different shafts on that level from the north to the south end of the Comstock, than to run these side drifts or lateral drifts of the tunnel as proposed?

A. No, sir, it would be much more expensive, leaving

out the cost of the tunnel itself, because you would in the latter case take the rock right out of the tunnel.

Q. Do you know what size it is proposed to run these side tunnels from the end of the Sutro tunnel when it enters or reaches the Comstock?

A. I do not, sir; I know what I should advise as an engineer. I do not know what is determined upon.

Q. Suppose you have now four or five of the leading mines upon the Comstock, worked from one end to the other upon the level of the tunnel, then it would not cost anything to drift from those mines, would it? Suppose the Belcher, the Crown Point, the Kentuck, the Yellow Jacket, on the tunnel level, would connect together and drift from one end to the other. That would take out several thousand feet. Now, I am talking of the remainder to be drifted through on that level; and the cost of it, compared with the cost of running this drift upon, or east of the tunnel level, and taking out the waste through the tunnel. What would be the cost?

A. I do not understand what a drift east of tunnel level you refer to would be. Do you mean a parallel drift in the east wall?

Q. Mr. Sutro, in his contract, undertakes to run a branch tunnel north and south, from the end of his main tunnel, which shall not be less than 500 feet east of the west wall.

MR. SUTRO. Mr. Chairman, I should like to correct that statement. The gentleman does not state the fact correctly. It is true that there shall not be more than 500 feet, but we may run inside of the lode, or alongside of it.

THE WITNESS. My own idea would be that, if Mr. Sutro's tunnel, arriving at the vein, should find a drift already made on a portion of the vein, a part or the whole of which could be used by him, with or without enlargement, in lieu of the new longitudinal drift to his own, he should buy the the right of such already constructed drift, and that the parties constructing it, if they were sensible men, would make a fair arrangement with him for that purpose. What

would be the result, if they were hostile to him, I do not pretend to say.

Q. I understood you to say that the mines in Germany—I do not know that you went beyond Germany, but in Germany—that they paid regular dividends. Do you mean that for the year round.

A. I do not mean to say that.

Q. Just make your own statement?

A. Some pay dividends, and some do not. When they have bonanzas, the practice, where the mines are under government control and supervision, has been to reserve the bonanzas, and to use it in order to keep up the regular average product of the mine, and it is not the custom to exploit every body of ore as rapidly as possible, in order to make a profit out of it and divide it among the owners or stockholders, and then to go into a long period of barren exploration. The reason for that is simply, that the government feels some responsibility for the laboring population, who are not, like our miners, able to move about from one district to another, but who reside in the district, and have for generations; and consequently it is felt to be a responsibility on the part of the government to see to it that they have steady work. They do not crowd the mines when they are in rich ore, do not discharge the force when they are in poor ore; and, as far as dividends go, you will see for yourselves, it may stop the dividends or increase the dividends. The mines keep a reserve fund, which enables them to go through a hard time without allowing the suffering to fall upon the laborer; the result is therefore more uniform than it would be on another system.

Q. I think my minutes of your testimony read, "That mines in Europe so worked declare regular dividends."

If I am mistaken in that, I would like to be corrected.

The WITNESS. I do not think I made any such sweeping assertion as that. There is nothing that can be predicated of the mines of Europe, as a whole, any more than in regard to the American mines as a whole.

Q. You know that, as a matter of course, mining is

the most uncertain business in the world, as far as productiveness is concerned?

A. As a mining engineer, I have always been accustomed to say it was not the most uncertain, but it is very uncertain; I will say that.

Q. Take the Comstock now, the bodies of ore that you have seen there—the body of ore as shown on King's maps,—can there be any certainty in mining, or any certainty in dividends, declared by any company on the Comstock?

A. No, sir; not as at present administered.

Q. How do you propose to administer the mines there, to make it pay?

A. I do not propose to manage the future. I suppose I can criticise the past better.

Mr. SUNDERLAND. A good many of us can do that. We all see the mistakes that we have made.

The WITNESS. But my general point is, that the consolidation in former times would have prevented that state of affairs by which one proprietor has been in luck, and another proprietor been out of luck, and both of them wasted money.

Q. You are aware of that?

A. Yes, sir; to say nothing of litigation.

Q. The litigation has not been between the legitimate mine owners, but it has been between the owners of mines first located upon the Comstock, and then other locations by parties who claimed there was more than one lode.

A. I thought there had been litigation between the owners—very extensive litigation—as to proper boundaries.

Q. Do you know what it cost to mine ore in early times upon the Comstock—how much per ton?

The WITNESS. Do you refer to the cost of the extraction simply?

Mr. SUNDERLAND. Extraction.

A. I cannot tell you exactly. I could refer to it in the reports of the companies. That is my only authority.

Q. Do you know what it cost to mill ore in 1861, 1862, and 1863?

A. I have heard of very high prices being paid. I do not know of my own knowledge.

Q. Do you know anything about the cost of supplies necessary for running the milling in those early times?

A. No, sir; I do not know anything of my personal knowledge before I commenced to look into the subject as Commissioner of Mines.

Q. Suppose the cost to have been greatly in excess of the present cost of supplies for both mills and mines, could the company at that time have afforded to work low-grade ores?

A. They could have afforded to work a lower grade of ores than they did. I believe it has never been denied, and I am quite sure you would not wish to dispute it, that in the early days, when the Ophir and the Gould and Curry were in bonanza, there was the most unnecessary expenditure of money. Inexperience and extravagance both combined to produce that result. Since these expenditures were all charged to the account of working the mine, it stands to reason that ores of lower grade could have been worked with profit than were really worked, or were supposed to be capable of it, at that time.

Q. So far as you have any personal knowledge, is there any want of economy now?

A. I believe that at present there is a great economy practiced on the Comstock lode; and, so far as my knowledge or opinion goes, I know of no general improvement that can be suggested short of an entire change of the system.

Q. I understood you to say the other evening that in mining, as mining has been carried on on the Comstock, taking out only such ores as at the time would pay a profit, that there was either an entire loss of the low-grade ores, or a great loss. That was what you designated as piratical

mining, not using the term piratical in any offensive sense?

A. Exactly.

Q. Then the Comstock is pretty much ruined now, is it not?

A. Very badly damaged by that.

Q. Would the Sutro tunnel improve that any?

A. I think it would.

Q. In what respect?

A. By leading to the extraction and working of these low-grade ores.

Q. How much deeper could you mine these ores below the surface—the low grade ores, taking them through the tunnel, for that is the purpose, and reduce them at the mouth of the tunnel—than they can be now raised to the surface and taken to the mills on the Carson river and there reduced?

WITNESS. Can you tell me what it cost to haul to the mills on the Carson river?

Mr. SUNDERLAND. You want to know what the railroad charges are.

WITNESS. What the whole cost is from the mine to the mill.

Mr. SUNDERLAND. I can tell you what the railroad charges are, but not the other charge.

WITNESS. I cannot answer the question until I know what that item amounts to.

Q. Then how can you form an opinion as to whether the tunnel would reduce the expense of mining and milling this low grade ore?

A. Because I am very strongly of opinion that, whatever that item amounts to, it is more than the cost of taking ore through the tunnel.

Q. When you speak of the cost of taking ore out of the tunnel, do you mean the absolute cost of taking it out, or charges that Mr. Sutro is entitled to impose?

A. My proposition, as a general proposition, is in regard

to the advantages of the tunnel, without reference to who owns it, or the contract existing with regard to it.

Q. Would the reduction in the expense of mining and milling be equal to the \$2 royalty upon all the ores taken out?

A. Yes, sir, it would; because they would not take out lower grade ore if it was not.

Q. Will not the imposition of a royalty of \$2 a ton upon the low-grade ores prevent the working of a great many low-grade ores in the Comstock?

A. I have no doubt that, if that tunnel imposes a royalty of \$2 a ton upon ore, there would be a line in value, below which ore would not be taken out. That line would determine itself by the experience of the company, with regard to those low-grade ores; but I hold myself that, when that point is reached, there will be in the progress of mining of the Comstock just what there has been hitherto. There would be a further reduction of expenses in other respects, so as greatly to enable those ores to be reached also, and particularly, I believe, that the price of labor would be sooner or later less than it is at present.

Q. Do you think the running of the Sutro tunnel can possibly affect the price of labor?

A. I do not expect that particular measure to do it. That is to come in course of time, with or without the tunnel.

Q. You spoke the other evening of the mining laws of Europe. Do you think that those laws, established in Europe by monarchical governments, are applicable to this Government, or the spirit of the people in this country?

A. No, sir.

Q. You spoke also of the changes in laws since this franchise was granted to Mr. Sutro, or rather since the Sutro tunnel project was first started. What changes have taken place? You spoke of the local laws having changed, and also the laws of the State of Nevada.

A. The State of Nevada, since that time, has passed a

general mining law, tried it for a year or two, and repealed it.

Q. When was that?

A. I think that was in 1867 or 1868; I do not remember exactly the year. I have read the law. I know that it was not executed, and I think it was repealed.

Q. What were the provisions of that law?

A. The provisions were in relation to the location of mines. I cannot recall them now. My reference to the subject, you will remember, was merely to say that the conditions surrounding mining in this country, are not as stable as they are in older countries, and naturally, therefore, capital is not invested, as a general rule, in mining districts with confidence.

Q. What local laws affecting the Comstock have been changed since then?

A. I am not able to tell you. I have stated they have been changed. I have stated there were several changes, both in federal and local legislation. I was mainly referring to the investment of capital in other places than the Comstock. I simply said, by way of illustration, that since then, in this limited period of time—since the Sutro tunnel scheme was first proposed—there have been even in Nevada, affecting the whole State of Nevada, changes in legislation. Congress has also made changes in its legislation, and local changes have been made in other mining localities.

Q. In what respect has Congress made any change?

A. The law of 1866; and they have passed a subsequent law amending it. I suppose they will pass a third law.

Q. Do you recollect the date of that law of 1866?

A. It was in July.

Mr. SUTRO. The 26th.

Q. In what respect did that law of Congress change the course of the Government, or any law passed by Congress, or contemplated by Congress?

A. It changed the course of the Government in a very important respect. It opened the door to the acquisition of a fee simple by means of patents, and raised the entire

question of the taxability of mining claims, which has been one of the most troublesome and important questions ever affecting mining industry.

Q. Has the Government ever interfered with the operation of any gold or silver mines, since their discovery west of the Mississippi river?

A. Yes, sir; over and over again.

Q. Where?

A. In many of the land districts of the country we find protests on file at the land office, and in cases where the Government has granted lands as agricultural, and complaint has been made that the lands were mineral lands.

Q. Has any law of Congress ever interfered with the sale of mineral lands, except under the law of 1866, July 26, and the amendment to it in 1870, authorizing the passage of the title from the Government?

A. Not that I am aware of. I do not think so. That is what I alluded to when I spoke of the Government changing its policy; would not authorize it before, and yet did it afterward.

Q. Has not every act authorizing the sale of public lands exempted mineral lands from sale in the act?

A. No, sir; such lands as were marked by the surveyors as mineral lands were reserved.

Q. Are you certain that that is so?

A. That has been so up to within, I believe, a few months. The Commissioner of the Land Office has recently reversed the policy of the Government in certain cases. Under Mr. Wilson's administration it was not necessary to make absolute proof, in applying for agricultural lands, that the land was not mineral. It was sufficient if the surveyor's report pronounced it agricultural.

Q. Don't you know that the patent passing lands from the Government, when the act of Congress reserves the mineral lands, does not convey title to mineral on the lands?

A. I know that when a title has once passed, any subsequent discovery of mineral on lands belongs to the man who got the agricultural patent, and cannot be touched.

Mr. SUNDERLAND. That is a question of law that I will not dispute.

WITNESS. I lay it down on the authority of the Commissioner of the Land Office, who said that to me the day before yesterday.

Mr. SUNDERLAND. I suppose there are about as good lawyers in the country as he is.

WITNESS. I believe there has been no case where a man has received a title for agricultural lands, where such title has ever been disputed by reason of the discovery of minerals or salines. He is required to make an affidavit, when he makes his application, that he knows of no minerals on the land. The land is presumed to be agricultural, if nobody comes up and swears it is mineral. There used to be no proof at all required until lately, except that negative proof.

Q. What was your answer to the question as to the present speculations in mining stocks of the Comstock?

A. I do not think it was asked me. If it was, I could not have given any answer from personal knowledge. I have no special knowledge on that subject.

Q. So far as the Comstock is concerned, is there any necessity for any more capital being attracted to that mine than is there now?

A. No, sir.

Q. Then the running of the tunnel would be of no benefit to the Comstock in attracting greater investment or capital at that point?

A. I do not think it would; that is to say, if you refer to any foreign capital or anything of that kind. There is plenty of capital in California to run the Comstock.

Q. Don't you think the Comstock is selling for a great deal more than it is worth now intrinsically?

A. Yes, I do; that is, I have no personal knowledge of what it is selling for, but if I take the reports, and I have seen the calculations which I suppose to be reliable—I did not make them myself—the Comstock is selling for between \$20,000,000 and \$30,000,000 to-day.

Mr. SUNDERLAND. Selling nearer \$40,000,000.

WITNESS. I think \$40,000,000 is a pretty high valuation for any mine. My opinion that it is too high for the Comstock is based on my own idea of the profits which a mine ought to pay.

Q. What is your information as to eastern capitalists or Europeans investing in mines upon the Pacific slope?

A. Some of our best mines are run by eastern capital—by European capital—and make large profits.

Q. What mine?

A. Sierra Buttes, in California, that has been owned several years by an English company, and they have made large profits. They have declared dividends regularly.

Q. What other?

A. The "Emma" mine, in Utah, owned by an English company, that is paying 18 per cent. dividend, and is expected to continue to do so for several years, certainly. I believe there have been several of our large gravel and cement mines in California sold to English companies.

Q. Has not more than half the eastern capital invested west of the Rocky Mountains been absolutely lost in the Rocky Mountains?

A. Yes, sir; western, too, for that matter.

Q. Then, do you think it is desirable for the Government to encourage foreign or eastern capitalists to invest in those mines?

A. Not if the system of mining is going to be what it has been.

Q. Mr. Newcomb stated that the loss in transmitting compressed air a little more than a mile in the Hoosac tunnel was 15 per cent. What have you to say as to the correctness of that statement?

A. I cannot say anything about it. I do not remember the figures. If you have got the Hoosac reports, why it is very easy to determine; but I cannot recollect them at this moment.

Q. Do you know anything of the practicability of taking

a sufficient quantity of water from the Carson river to a point opposite the tunnel to concentrate ores or reduce them?

A. I do not. I simply traveled over that country very rapidly, and have no opinion.

Q. General Day reports—I have the report here—that there is a fall from the Mexican dam, which is the highest dam upon the Carson river and almost the highest dam at a point where a dam can be built, to a point opposite the mouth of the Sutro tunnel of 250 feet. It is now proposed, at a point $5\frac{1}{2}$ miles above Sutro tunnel, to erect a dam 155 feet high, which would throw the water back to the Mexican dam. What fall of water would you practically get, using the dam as a reservoir, from that dam down to a point opposite the tunnel?

A. I don't know anything about the region there, and I don't think I had better try to answer a question that involves a knowledge of the region.

Q. I believe you stated Saturday night that the formation upon the river there would hold water?

A. I said that trachyte would hold water.

Q. Do you know what the formation is on either side of the Carson river?

A. I know nothing in detail about it, except I traveled through that region, and I believe it to be composed generally of rocks, (volcanic and igneous rocks;) in other words, not distinctly stratified rocks.

Q. Have you examined the formation on either side of the river, say from Empire City?

A. I have not examined it.

Q. Then you cannot say whether the rocks there would hold water or not?

A. I do not know anything about the rocks of any particular spot. I do not think I undertook to make any specific statement about the locality the other night. If I gave you the impression I had personally examined the locality, I was misunderstood.

Mr. SUNDERLAND. I do not think you did, but I understood you to say that the rock there would hold water.

A. From the general impression of the rocks in that region, I believe it would; that is all.

Q. You say that, in concentrating ores, the first necessity is plenty of water?

A. Yes, sir.

Q. What quantity of water would be required to reduce 1,000 tons a day—to concentrate and reduce?

A. I could not answer that. It would depend on the manner in which the works are arranged.

Q. Suppose you had a fall of 90 feet, then about how much water would you require?

A. The fall would not help you at all in concentration, except as a means of power.

Q. You require considerable fall for concentration, do you not?

A. Simply for the location of the building.

Q. You require a power to move your automatic machinery?

A. Yes, sir.

Q. Can you form any estimate of the quantity of water that would be likely to flow out of the tunnel that could be relied upon?

A. No, sir; I cannot form any definite estimate about it. I think, as a minimum, you would get 500 inches.

A. You have stated that coal at \$12 a ton would equal wood at \$8 a cord?

A. As a steam generator.

Q. Have you any idea what coal would cost at the mouth of the tunnel?

A. I could not answer from personal knowledge, but I believe it could be put in San Francisco for \$14 or \$15.

Q. Do you know what it sells for at Reno?

A. I do not know; but that would be an entirely different matter, if there were large contracts, of course. I know the Rocky Mountain coal companies are very anxious

to get their coal to the West, and put it down as low as they can afford to carry it. It would be a question between the company and the railroad. In using it, unless you have long contracts, you would be at the mercy of the railroad companies, which is a very serious objection.

Q. Do you know what wood could be delivered at the mouth of the tunnel for?

A. I have no personal knowledge.

Q. Now, about the present saving of the metal in the ores, do you know enough to give an opinion as to the amount of assay value that is now saved?

A. It is my opinion that over 80 per cent. is saved; that is to say, that over 80 per cent.—from 80 to 82. That is my own estimate—is the saving, if you reckon everything, that finally finds its way into circulation. I am not speaking about what the mines receive, but what is actually extracted sooner or later from the ores and tailings, slimes, and everything.

Q. So far as the Government is concerned, and so far as the people of this country are concerned, does it make any difference who receives the metal out of the ore, and whether it is equally divided between the mines and mills, or whether the mines get it all?

A. That is a political question. I do not know whether it makes any difference or not. It is a question as to what the Government has got to do in that matter. For my own part, I am very free to say that I do not think it is any business of the Government whether its citizens get the best or the worst of a bargain.

Q. That is a matter to be left to any contract made between the mills and the mining companies?

A. Yes, sir. I do not think it is a subject upon which I am an expert. It is a question of political economy.

Q. I understood you to say you had official statements furnished you in reference to this guarantee of 65 per cent. What official statements?

A. Not official statements, perhaps, but statements made

to me in my official capacity—received from the proprietors of mills, and from superintendents some years ago, whose names I have forgotten.

Q. You always got what you asked for. Was not the information always given freely to you when you made inquiries of the mining companies?

A. Not in every case, but I have had very good success. I have had my own agents.

Q. If you have not examined the formation on either side of the Carson river, can you give any opinion as to what the percolation would be?

A. Simply from the fact—only a general opinion from the fact—that I know what those rocks are when the rocks are declared to be of a certain class. I also judge from the fact that the Carson itself river does not percolate and disappear at that spot.

Q. Have you been to the head waters of the Carson river?

A. No, sir.

Q. You do not know that any one of the branches of the Carson river is larger than the Carson river is at Empire City?

A. I do not know that at all personally.

Q. I understood you to say you thought this royalty was good security for the advancement by the Government of \$3,000,000?

A. No, sir; I declined to answer that. I said it was a matter to be left to contract and the action of the Government; that I did not belong to the department of the Government which determined its policy, but if I was asked whether the mines, in my opinion, or the Comstock would last long enough to make an annual payment of such a royalty on the production, amounting to \$500,000 or \$600,000 a year, and whether that was good security for the repayment of the \$3,000,000, I should say certainly it was.

Q. Suppose the Government should grant \$3,000,000 to the Sutro tunnel company, and it proposes to pay back

without interest one quarter the net proceeds, without the Government having any control over the keeping of the accounts of that company, what, then, would you say as to the security?

A. I do not think that that is a question that I am an expert at all in regard to. I do not think, as a private citizen, that that sort of an arrangement, giving the Government no control over the accounts, would be a fair one to make.

Mr. SUTRO. It is proposed to do that. The bill provides that the Government shall appoint commissioners to examine and report upon the condition of the works and the condition of affairs generally; consequently the Government has absolute control.

WITNESS. If it is proposed by any bill to have the Government cheated, why that bill ought to be defeated; that is all I have to say about that. I have nothing to do with that matter.

Q. Do you know Mr. Janin?

A. Yes, sir.

Q. He is a mining engineer, I believe, is he not?

A. Yes, sir.

Q. Where did he graduate?

A. I do not know that he graduated anywhere.

Q. Where was he educated?

A. He has been educated at Freiberg, and he was there several years. We have no regular graduation at Freiberg, but he was educated there.

Q. He says in one of his reports that the process used there now for the reduction of ores is the best that could be adopted for the reduction of the ores on the Comstock. What have you to say about that?

Mr. SUTRO. Where does he state that?

Mr. SUNDERLAND. In one of his official reports.

Q. Does not he state anything besides that?

Mr. SUNDERLAND. He states a great many other things besides that, but not in that connection.

WITNESS. There are several processes in use for the reduction of ores, but I do not know which one he refers to.

Mr. SUNDERLAND. The process referred to is the one in use at the time he made that report.

WITNESS. I do not know the date of the report. The Freiberg process has been changed within ten years.

Mr. SUNDERLAND. He speaks of the process used on the Comstock as the best that could be adopted?

A. I have stated the same thing in one of my reports. As far as the application of the raw amalgamation is concerned, I regard the Washoe process as the best for that purpose.

Q. How do the ores of the Comstock compare with those in the different mines of Germany, generally, as to their freeness—the absence now, I mean, of base metals?

A. They have certain grades of ores abroad that are comparatively free, and then again the same kind of minerals occur in the German mines.

Q. Do you know that at times in the Comstock there is a great deal of base metal to interfere with the amalgamation of the ores?

A. I know that, and I don't think the Washoe amalgamation is as successful on that grade of ore. It is for the reason that most of the ores belong to a different class that that process is considered of itself to be adapted to them.

A. Is there not a great deal of metal carried off in the sulphurets from the first process?

A. More or less. I think that the first process, as applied in most of the mills at Washoe, is not calculated to reduce sulphurets at all. It is more especially the silver and gold, that occur native and free in the ore that is extracted by the first process in the mills, and I ought to add right here, to explain my statement of the Washoe process—I do not need to defend Mr. Janin—my own statement is that the Washoe process is the best in itself as a theory, and is capable, when properly managed, of being improved and of doing the work for that class of ores. I do not mean to indorse the practice in every mill. There

are twenty different theories going among the mills now. If you travel from one mill to the other, you will find a totally different practice in regard to some important point, each man regarding his as the best.

Q. Will not metal carried off by the sulphurets become free by salting the tailings and exposing them to the air?

A. I do not think it will.

Q. What process is it necessary to resort to?

A. I think that the tailings, which are a little different from the sulphurets, might become oxydized by exposure; but for the treatment of the slimes, so-called, which are mainly sulphurets of the precious metals, sulphurets of silver, chemicals in the pans are necessary.

Q. Is there not a great deal of metal that is lost in the first process of the working of the ores from the Comstock contained in the pyrites of iron?

A. I cannot give you an exact statement as to that. I have no doubt that in some ores—of some of the bodies—it has been the case. I do not know how it is with the general run of ores.

Q. So far as they are concerned, will they not be oxydized by salting and exposure to the air?

A. I have never seen it practiced upon pyrites in that way. I do not know that salting will help them.

Mr. SUTRO. You have been asked whether some of the shafts at present existing on the Comstock lode would not be down to the tunnel level. I want to ask you now whether it is not desirable that they should connect with the tunnel?

A. Yes, sir.

Q. Would it not, in fact, be the result of the construction of the tunnel, that all these shafts would be connected with the tunnel?

A. I believe that is a part of the plan of running the tunnel.

Q. Do you see any difficulty in sinking these shafts down and connecting them with the tunnel, by first putting the bore-holes down in order to let the water out?

A. There is no impracticability about putting the borehole down.

Q. Now, I want to ask you whether the tunnel will not allow deeper explorations upon that lode than could be done without the tunnel?

A. I think I said the other night I thought it would. I look upon it that there is a difference between the absolute necessity and the economical necessity in that matter, as in all other matters. What is the limit of mechanical engineering I do not know; but economically we have never gone deeper by shafts alone—than 3,000 feet.

Q. Speaking economically, in order to make the mines profitable, would it not be more profitable to open up a new basis of operations at the tunnel level than to go simply down from the surface?

A. I believe I have explained all the points that would be advantageous. I do not care to sum them up again.

Q. Would not the value of the Comstock be largely increased by making an exit for the water and the ore, 2,000 feet below the surface?

A. As a general proposition, if I answer yes, it would be giving a categorical answer to what I have been explaining in detail. I have spoken at length of the advantages which would be conferred on the lode by it.

Adjourned to meet at the same place March 26, 1872, 7½ o'clock.

HEARING TUESDAY, MARCH 26TH.

C. A. Luckhardt called and examined.

By Mr. SUTRO:

Q. You are a mining engineer by profession?

A. Well, I have studied chemistry. I afterwards took up mining engineering.

Q. You are a practical mining engineer?

A. I did not make mining engineering my entire study. I have studied chemistry in Marburg, and I afterwards spent a year on the Harz, after I got through my studies at Marburg; and from that, most of my time I spent in mining engineering.

Q. Have you followed anything except mining and metallurgy since you left the university?

A. No, sir; with the exception that I set up two chemical works.

Q. It belongs to the same branch, does it not?

A. Not exactly. I spent fifteen years on mining, and following the profession of a mining engineer and metallurgy.

Q. Have you visited any of the mines in Europe?

A. Yes, sir.

Q. What mines have you visited there?

A. A great many of the mines on the upper Harz. I have visited some of the mines in England, and have been employed there.

Q. Have you visited any of the mines in the United States?

A. Yes, sir.

Q. In what parts of the United States?

A. In Maryland, in North Carolina, in California, in Nevada, and in Lower California, and in Arizona.

Q. You have resided on the Comstock lode some time, I believe?

A. Yes, sir.

Q. For how long a time?

A. Nearly six years.

Q. At Virginia City?

A. All the time I was there I resided at Virginia City.

Q. What were you engaged in there?

A. Mining.

Q. What position did you occupy?

A. Position of mining engineer and assayer.

Q. Who were you employed by?

A. I was employed by Paxton and Thornburg as an assayer, and employed by the trustees of the Justis Mining Company as superintendent of their mines, and employed by the president of the Ophir, and took charge of the Ophir, and by the trustees of the North American company as superintendent of the North American, and by the Bank of California as mining engineer.

Q. How long have you been employed by the Bank of California?

A. Nearly five years.

Q. What were the special duties that were assigned to you?

A. To examine the mines that they wished to have examined, and report the appearance and probable product of those mines.

Q. You were employed, then, as a general agent, or as an expert to report on all the mines?

A. Yes, sir; on all the mines to which they sent me; on all those mines they wished to have examined.

Q. What was the object of the Bank of California in employing you as mining engineer?

A. Well, I suppose it was to receive truthful information as regards the state of the mines.

Q. The Bank of California is supposed to be a banking institution, is it not?

A. Well, I suppose so.

Q. And they employed you to render a report of the condition of the mines?

A. Yes, sir. They employed me through their agent, Mr. Sharon, to examine such mining property as they wished to have examined.

Q. How often did you report to the Bank of California?

A. Every day.

Q. Did you make a written report every day?

A. Well, for the first two years I made a written report, as soon as I could get opportunity to complete such. Sometimes it took me three days to make one report, but afterwards I sometimes made a report every two days, when there was nothing new to report upon.

Q. What was the special object they had in view, in employing you to give them specific information about the mines or condition of the mines, &c.?

Mr. SUNDERLAND. Mr. Chairman, I shall object to the question, unless the witness first states he knows what object they had.

Mr. SUTRO. I am asking the witness what the object was.

Mr. SUNDERLAND. He has not stated that he knew. He can only know by their telling him.

WITNESS. I have my opinion about it. I do not know what their object was, but from the conversation and the injunctions put upon me, I inferred that they wished to know the exact truth of the state of the ores, &c.

Q. Was it for the purpose of stock operations?

A. Well, I could not say that—what it was for.

Q. What interest could the Bank of California have in sending you to a mine in which they had no interest in getting information?

A. Probably the interest they had in sending me there was to see what the state of the mine was, so that they might—these parties interested—buy into the mine, by stock, or obtain ores from the mine. The injunction was put upon me, when I was employed, to keep all that I saw there for their especial benefit and no one else's.

Q. In other words, you were to keep secret all you found out about the mines, and report to them?

A. That was the purport of it, I suppose.

Q. You say you made written reports? How many written reports do you think you made during that five years?

A. Oh, well, probably nearly a thousand.

Q. A thousand reports?

A. Yes, sir.

Q. Then you must have entered these different mines, and visited them, and examined them in all their details?

A. Oh, yes, sir; certainly.

Q. That made you very familiar with those mines?

A. Well, yes, it did.

Q. Do you know of any other person who had as much opportunity to study those mines as you had.

A. I do not know of anybody, except it should be that each superintendent, or each foreman of each mine, was as well posted as regards that mine as I was. But about the entire mines, I do not think there was anybody there that had the advantages I had of becoming posted.

Q. Is there any person living who had as much opportunity of knowing the whole condition of the Comstock lode as what you do?

A. I cannot answer that. If they had obtained admission to those mines, they had the same opportunity that I had. I do not know how many other people visited the mines besides myself.

Q. How did you gain admission to those mines?

A. By an order to the superintendent or foreman from the agent of the Bank of California.

Q. Please state who he was.

A. Mr. Sharon.

Q. Did that order from Mr. Sharon gain you admittance to all the mines?

A. It always gained me admittance where he gave me an order.

Q. Did other people have a chance to go into those mines any time they pleased?

A. Not as a general thing.

Q. Then you were rather a privileged character?

A. Yes, sir.

Q. In other words, that order from Mr. Sharon rather worked as a charm, did it not, and gained you admittance?

A. I do not know whether it was a charm or whether the man had a right to send me there.

Q. But you gained admission to all the mines, or nearly all?

A. Yes, sir.

Q. Now, you say that some of the superintendents knew about their own mines as much as you knew?

A. Yes, sir.

Q. Are any of those superintendents mining engineers?

A. The entire time I was on the Comstock I only knew of two whom I would suppose to have any knowledge of being mining engineers.

Q. Are they there now?

A. No, sir. One is dead, and the other owns a mill there.

Q. They did not want to keep any superintendent there who was a mining engineer did they?

A. I do know anything about that.

Q. You say that there were but two all the time that you were over at Virginia City—but two mining engineers in charge of the mines; consequently the other parties who had charge of these mines were not educated mining engineers?

A. I should not take them to be such.

Q. How do you account for it that men were placed in charge of the mines who were not educated mining engineers, while the Bank of California employed you, an educated mining engineer, to give them private information?

A. Well, in working a mine, the way mining has been carried on in Washoe, Virginia, it is not always necessary to have a mining engineer in charge of a mine. A practical knowledge of handling men sometimes is preferable to an educated mining engineer. That is the reason why.

Q. But suppose you were to employ a mining engineer

—one who possesses those qualities you speak of—would he not be preferable?

A. Oh, unquestionably.

Q. Then what is the reason they do not employ any one there having those acquirements?

A. That I do not know.

Q. Don't you account for it by the fact that they want men who are connected with them in a manner, so as to manage affairs to suit them?

A. I think that mining has been carried on in Virginia City, not alone for the purpose of developing mines and making them remunerative institutions, but also for the purpose of stock speculations.

Q. Then the Bank of California came to the conclusion that they required some private information, and they required an intelligent mining engineer to give it to them?

A. I think they thought so from the fact of employing me for that length of time.

Q. They employed you for how long?

A. Nearly five years.

Q. And you visited the mines from day to day?

A. Yes, sir.

Q. Did you visit all portions of those mines; not only those where they were working, but those that had been worked before and had been abandoned?

A. Yes, sir. I won't say all, because some drifts were impenetrable.

Q. But all those portions of the mine where you could get access to—where it was possible to get access to?

A. Yes, sir.

Q. In making a report upon a mine, would you go to work and visit every portion of that mine, try to get into every drift, take out samples of ore, assay them in that manner, and examine the mine from the lower level to the uppermost?

A. Yes, sir.

Q. Then the reports you made to the Bank of California at that time must possess great value?

A. As far as throwing light upon the conditions of those mines, they may be worth something as records; but whether they were of great value, that, of course, those people have to judge of who read them, and not I, who made them.

Q. Suppose they wanted to ascertain the condition of the mine at this time.—

Mr. SUNDERLAND. You can buy them very cheap, Mr. Sutro, if you want them.

Mr. SUTRO. Buy what cheap?

Mr. SUNDERLAND. Those reports.

Mr. SUTRO. I suppose they were only prepared and used for temporary stock jobbing purposes, and, of course, they were not intended to be of value afterwards.

Mr. SUNDERLAND. I thought you considered them of great value.

Mr. SUTRO. No doubt they were considered very valuable at the time, or the Bank of California would not have employed this gentleman to make them.

Q. What I want to know is this: whether these reports are not of a high value as giving a record of what has been done in those mines—as to the condition of such portions of the mines which afterwards caved in, or were filled up.

A. They were certainly useful as a record.

Q. Do they not give you information as to the existence of bodies of low-grade ores that were left behind, which it is difficult to obtain now?

A. Some of them do.

Q. Have you retained copies of those reports?

A. Probaby one-third or one-half, may be. I reported for a year without taking copies; and very often afterwards I did not take copies.

Q. After all the experience you have had on that Comstock lode, from one mine to the other, and after all these examinations you have been making for five years, what conclusion have you arrived at, as regards the character of that lode?

A. I think that the Comstock is one of the largest silver-bearing lodes in existence, or known.

Q. Do you know of any lode of which we have any record in history that was of equal value to the Comstock lode?

A. No, sir; not in so short a space of time.

Q. Do you not consider it the most valuable lode that is in existence now, of which we have any record?

A. Yes, sir.

Q. Do I infer from that, that you consider that this fissure vein extends downward indefinitely?

A. Yes, sir.

Q. Do you base that opinion upon these repeated investigations and examinations, upon geological facts which you have ascertained?

A. Yes, sir.

Q. There is no question in your mind about that?

A. No, sir.

Q. Have you any doubt about the lode being ore-bearing?

A. I think it will be found to be ore-bearing as long as work is done upon it.

Q. Or, in other words, as far as you can reach down by mechanical means?

A. Yes, sir.

Q. In your examinations upon that lode, have you found that any large bodies of ore have been left behind, being of too low a grade to be worked advantageously under the expensive system of mining?

A. Oh yes, sir, I have.

Q. Can you form any estimate of the extent of those bodies?

A. No, sir. I do not think it is possible for any man to estimate the quantity of low-grade ore that is yet standing in the Comstock above their present lowest workings, because these ore bodies have never been explored sufficiently to get at their extent. Still, I may say that they are very large, and that they will yield immensely.

Q. Is it possible for anybody to compute in dollars and cents what that ore is worth?

A. No; it would be guess work.

Q. Don't you consider it almost incalculable?

A. I do not know how to take the word "incalculable." Figures could be made.

Mr. SUTRO. I mean immense.

Mr. SUNDERLAND. Mr. Chairman, I should like to have the witness supply his own words, and express his ideas and opinions.

Mr. SUTRO. The witness has a perfect right to ask for an explanation. He has a right to inquire as to what is meant by the question. I used the word "incalculable," and the witness simply wants to know what I mean by that word.

Mr. SUNDERLAND. You have no right, Mr. Sutro, to suggest the answer to the witness.

The CHAIRMAN, (Mr. SESSIONS.) He is your witness, Mr. Sutro, and the objection is made that you lead him too much. Ask him a question and then let him answer. He is an intelligent man.

WITNESS. I mean to say that ore in the mine, in the Comstock lode, is of large extent—great extent, unquestionably. But I would not undertake to estimate its quantity. I think the same number of tons of ore, and even more, will be taken out of the mine from those bodies of low-grade ores as have been taken from the richer ores.

Q. What do you call low-grade ores—going down as low as what?

A. I call low-grade ores anything that, up to the time I left the Comstock, didn't pay for working under the system they have there.

Q. How much was it necessary to assay, in order to make it profitable to be worked?

A. Seventeen dollar ore. Ore that assayed \$17, was the lowest I know to have been worked.

Q. How much would that yield?

A. That would yield \$10 per ton.

Q. Would it pay to take ore out of the mine, send it to the mill, and pay \$12 for milling, that would yield \$10.

A. I do not say it paid; I only say that ore had been taken out and worked, and I call that low-grade ore.

Q. What mill was it sent to; was it one of the Union Mill and Mining Company's mills?

A. That I do not know.

Q. Then that would have run the mine in debt?

A. Yes, sir; unquestionably.

Q. The mill would have made the money, wouldn't it?

A. The mill got its price for crushing.

Q. Then the mill made the money and the mine lost?

A. Yes, sir.

Q. How do they make up these losses? Suppose a mine runs behind, how do they make up the loss?

A. Put on assessments. It has been customary, as far as I know, if a mining company sends ore to a mill company, to have the mill company return a certain percentage of the ore; and if that percentage from the assay was not given, that the mill company should pay a reclamation.

Q. Have you ever known of the Union Mill and Mining Company paying any reclamation to any mining company?

A. No, sir.

Q. You do not know of any?

A. No, sir.

Q. Who owned that Union Mill and Mining Company? Who are the parties who are supposed to own it?

A. Well, if you ask me to tell you who the parties were, that I could not tell you, because I never inquired into the matter; but it was the general opinion that it was owned by those parties who had the control in most of the mines on the Comstock.

Q. Then it was all one concern pretty much, was it not?

A. That was the general opinion. I did not inquire into details. I followed the general opinion. I had nothing to make me think the contrary.

Q. Have you ever known any men over there who are known to compose the "California bank ring," who had the control of any mine that they did not own any stock in? Did you ever hear of such a case?

A. I never knew of such a case. I have heard of it.

Mr. SUNDERLAND. I want the witness to tell only what he knows.

Mr. SUTRO. That is what I am endeavoring to have him state.

Mr. SUNDERLAND. No, you are not trying to get that out at all.

WITNESS. Some of the foremen asked me at various times if I had stock on such and such a mine, and I asked them why they wanted to know. They told me for the purpose of getting my "proxies."

Q. What did they want that for?

A. To facilitate, I suppose, the re-election of their superintendent or themselves, or their friends, and it may be in that way that the control of the mines has been obtained at times by parties not really owning the stock, by just voting some of the stock by proxy.

Q. Is it the common report that—

Mr. SUNDERLAND. I object to common report.

Mr. SUTRO. Why object to common report? We have been asking every witness we have had what he knew by common report.

Mr. SUNDERLAND. If that be true, it is time to stop it. That is all I have got to say.

Mr. SUTRO. Why, common report is public opinion, and public opinion is a pretty good thing.

The CHAIRMAN. Mr. Suto, what is the question?

Mr. SUTRO. The question is, "Is it common report that the Bank of California has been manipulating these mines by loaning money on the stock, and, without owning stock, by getting these proxies, they put in their men as trustees."

The WITNESS. Yes, sir; that was common report.

Mr. SUNDERLAND. I move to strike that out.

Mr. SUTRO. You move to strike it out; why?

Mr. SUNDERLAND. Yes, sir. It is certainly not legitimate testimony. I do not suppose this committee wants to hear statements that are not testimony, and consume time here and to bankrupt me, as far as I am concerned in taking down all this testimony and the printing of this book. Now he says it is common report that the Bank of California got the proxies, loaned money on stock, and by that means controlled the elections where they did not own the stock. He does not say they do not own any. Now I do not know that there is any criminality in loaning money on stocks, or getting a proxy to vote stocks, and therefore it is immaterial in my view. It is not evidence of anything to commence with, and in the next place it is immaterial. It is not the best evidence, even if it was material. He does not know whether that was practiced or not by the Bank of California, and even if it was, it is wholly immaterial to any issue here. It does not make the Sutro tunnel any better or worse. It does not increase the necessities, so far as the Comstock is concerned, for running the tunnel.

Mr. SUTRO. Mr. Chairman, we have had the same exhibition during the whole of the examination. Every time we touched upon anything that appertains to the Bank of California, and their manipulations and doings, Mr. Sunderland objects.

The CHAIRMAN, (Mr. SESSIONS.) He did not object to that. He objects to your proving from common rumor and common report.

Mr. SUTRO. I understand that, but Mr. Sunderland speaks of this not being criminal in its character. No one has charged that it is criminal at all. He excuses himself before he is accused. We certainly have not charged him or any one, and my question implied nothing of that kind. I have simply asked what was the common report in regard to the manipulation of the bank. It is simply impossible to get at the positive and definite facts about the manipulations of that bank without bringing their books here, and bringing their men here, and swear-

ing them; and I do not know whether we could get the truth out of them even then. You cannot get at it except by common report of the whole community. The inquiry is pertinent to this examination, as tending to show the motives of the opposition to this tunnel.

The CHAIRMAN, (Mr. SESSIONS.) You may ask the question, if it is the general report of the community.

Mr. SUTRO. He has already answered the question.

The CHAIRMAN, (Mr. SESSIONS.) Proceed to something else, then.

Q. I want to ask you, if low-grade ore is sent to the mills owned by these parties, this Union Mill and Mining Company, from a mine in which they do not own much stock, but which they have control of, whether that is not taking advantage of the stockholders of that mine?

Mr. SUNDERLAND. I object to that, because, first, before that question can be asked, they must show that there was truth in the statement.

The CHAIRMAN, (Mr. SESSIONS.) I do not understand the question.

Mr. SUTRO. I will repeat it. My question is, that if the trustees in charge of a mine in which they may have but very little ownership, or none at all, send ore to mills which belong to their friends, or to the very parties who have the control, which ore it does not pay to mill, whether they are not taking advantage of the stockholders of that mine?

The CHAIRMAN, (Mr. SESSIONS.) That is self-evident, I suppose.

Mr. SUNDERLAND. Therefore he should prove the fact.

The CHAIRMAN, (Mr. SESSIONS.) I do not see that that is material, because that is a matter of argument. You may prove the facts.

Mr. SUTRO. I will ask the witness how these losses in the mines are made up; how they retrieve their finances again after they have lost a good deal of money and expended a good deal of money?

The WITNESS. How do you mean?

Mr. SUTRO. How do they raise money there? How do they get money?

A. By assessments, or sometimes by borrowing money, I suppose.

Q. In levying assessments, is not the stock sold out after a given time, if the assessment is not paid?

A. That is the general rule. It is advertised in the papers for sale, and if the delinquency is not paid, the stock is sold.

The CHAIRMAN, (Mr. SESSIONS.) Their by-laws authorize that, do they not?

Mr. SUNDERLAND. The statutes do. It is a matter of public law.

The CHAIRMAN, (Mr. SESSIONS.) I supposed so. I supposed the statute of the State or the by-laws authorize it.

Mr. SUNDERLAND. It is wholly immaterial, and has nothing to do with the case at all.

Q. I want you look at this paper "THE ALTA," published at San Francisco, California, in which there is a delinquent list advertised of the Gould and Curry Silver Mining Company, a mine on the Comstock lode. Please look at that advertisement, and tell us how many delinquencies are advertised in the names of trustees, and how many in the persons own names?

A. That would be quite a calculation, as opposite the name of each trustee is the number of shares, and the same with regard to others than trustees.

Q. Please look at it, and say if there are not nine-tenths, or five-sixths at least that are under the name of trustees?

A. Yes, sir.

The CHAIRMAN, (Mr. SESSIONS.) These are delinquents who refuse to pay their assessments.

Q. The point I want to get at is, in whose name the stock stands. The stock transactions are made without transfer of stock, and consequently the stock remains standing in the name of the trustee.

Mr. SUTRO. I would like to have that list read; it is a curiosity.

Mr. SUNDERLAND. Put in the whole newspaper.

Mr. SUTRO. No, just this advertisement. It shows how the mines are manipulated.

Mr. SUNDERLAND. I do not think there will ever be another advertisement of that kind.

Mr. SUTRO. Well, I will not read it. Do you know anything about the difficulties of mining to great depth on the Comstock lode?

A. I think that some difficulties have presented themselves already, down to a depth of less than 2,000 feet.

Q. Will you tell us what the difficulties in mining are?

The WITNESS. Difficulties in mining to what depth?

Mr. SUTRO. To a great depth.

Mr. SUNDERLAND. Name some depth.

The WITNESS. It is the want of thorough ventilation, expense in hoisting water, or to get rid of the water, and the expense of hoisting ore.

Q. What do you know about the water in Comstock lode. Would you consider the quantity pumped from the Gould and Curry mine as a fair average of the whole lode, say for each 1,000 feet in length?

A. Well I really could not state that, because at this present moment I do not know what quantity of water does come from the Gould and Curry.

Mr. SUTRO. The quantity is stated in the report of the superintendent at 3,500 gallons per hour.

WITNESS. No, I do not think that would be an average. I think it would be more than an average.

Q. How much more do you think it would be than an average for every 1,000 feet? I will make my question plainer. Suppose, in the course of a thorough exploration of the Comstock lode, which is said to be 22,000 feet in length, a shaft be sunk every 1,000 feet, how much would you consider the proportion of water in each one of those shafts at the same depth as the Gould and Curry mine is at the present time, in comparison with the quantity pumped out of the Gould and Curry mine?

A. I think, if I understand you aright—

Q. Do you understand my question? How much water would you get in each shaft 1,000 feet apart, provided there were 22 shafts on the whole lode? Would you get as much as you get in the Gould and Curry mine now?

A. No, sir.

Q. How much do you think they would get, comparing it with the Gould and Curry mine? Would they get three-fourths, five-sixths, or one-half, or what do you think they would get? It is only arriving at a general idea from your own knowledge of the country; you could not tell positively about it, but how much do you think there would be?

A. I think they would get about one-third of that in each one of those shafts, because, at the present moment, it drains more than 1,000 feet, and if you have a shaft every 1,000 feet, each shaft would drain horizontally to its depth 1,000 lineal feet to the depth to which the shaft had been sunk.

Q. Will you be kind enough to state how much that would come to at your figures, if 22 shafts—

Mr. SUNDERLAND. I object to any supposition about the number of shafts.

Mr. SUTRO. The witness' statement is upon the supposition that there are so many shafts in so many thousand feet, and he is making his figures on that.

WITNESS. That was the question, as I understood it.

Mr. SUNDERLAND. In the first place, the Comstock is not 22,000 feet long.

Mr. SUTRO. My question is supposing that the lode was worked intelligently, and 22 shafts were on the whole length of it—that is to say, one every 1,000 feet apart—how much water would there be, in all probability, in each one of those shafts, as compared with the quantity of water in the Gould and Curry mine?

Mr. SUNDERLAND. In the first place, the Comstock is not 22,000 feet long.

Mr. SUTRO. It is so stated in the commissioner's report.

Mr. SUNDERLAND. Hold on; let me get through. In the

first place, there are no 22 shafts there. There is more than half the distance of the Comstock found to be absolutely barren, from the prospecting already done, without the aid of Mr. Sutro's tunnel. Now, what is the use of estimating upon shafts that never will, and never did exist?

Mr. RICE. Suppose that by means of the Sutro tunnel we develop the fact that there is ore on the whole length of the lode, and then the witness should assume that it is necessary to have a shaft every few feet; then it would be very proper for us to get at the amount of water which would come through all these shafts, would it not?

The CHAIRMAN. (Mr. SESSIONS.) Yes, if you could; but I do not think that you have any data to go upon. The witness might state, of course, how far apart these shafts should be to work the lode advantageously; and how you can get at the quantity of water, assuming——

Mr. SUTRO. Mr. Chairman, we have a gentleman here who probably knows more about the Comstock lode than any living man. For five years he has been at these mines; he has observed every fact in connection with them; he knows how much water there is; and if we are ever going to arrive at any opinion in regard to the water, why the evidence of this gentleman is more valuable than that of any one else.

Mr. SUNDERLAND. I am surprised, if he is so valuable to the Comstock, that he is not continued at it. I wonder that his services have not been secured permanently, at great expense, if need be.

Mr. SUTRO. It may be the witness did not care to stay there, and I think that is the fact in the case.

Mr. SUNDERLAND. It is not worth while to pass any such panegyrics at all upon the witness.

Mr. RICE. It is proposed to arrive at the fact by the same mode of figuring that the commissioners pursued. The question is simply this: from what he knows of the water on the lode, and provided that the lode were worked its whole length——

Mr. SUNDERLAND. Does he state how much water there is in this Gould and Curry mine?

Mr. SUTRO. It is contained in the report of the superintendent. He has stated there would be one-third in each one of these 22 shafts. I want him to figure out how much that would be.

Mr. SUNDERLAND. That is one of the wettest mines on the Comstock, and he wants to figure from that.

Mr. RICE. He takes one-third of the amount of the water.

The CHAIRMAN, (Mr. SESSIONS.) How does the amount of water in the Gould and Curry compare with the amount of water in the other mines on the lode?

WITNESS. There has been more water there than in any of the other mines.

Mr. SUTRO. More than in the Ophir mine?

A. More than in any of the other mines, from the fact that the explorations and drifts in the Gould and Curry were very extensive, and deeper than in any of the other mines. The Gould and Curry mine had, two years ago, more water than the Ophir.

Mr. SUTRO. We are not speaking of two years ago. The superintendent's report was made last September.

Mr. SUNDERLAND. That is what the witness knows; he has not been there since.

WITNESS. I was answering about the five years that I had been there.

Mr. SUTRO. And we are basing our calculations here upon the water in the mine last September, and he states there are 3,500 gallons.

WITNESS. That I do not know anything about.

Mr. SUTRO. At the end of two or three dry seasons there were 3,500 gallons, and I am basing my calculations upon that.

WITNESS. That I do not know anything about, because I was not there to see it. I have heard that the water has decreased in the last two years. During the time I was there it did not decrease very materially.

Mr. SUTRO. What do you think is the cause of its decrease?

WITNESS. The cause of the decrease of the water——

Mr. SUTRO. Do you think it is caused by the dry season?

WITNESS. That has a great deal to do with it. I think the main cause is, that the water in the Comstock, so far as I know, exists not alone in the bodies of ore on the bonanzas, but it exists in pockets, which are surrounded by clay seams, and when these pockets are cut, the water is let out. Now, as people generally do not like to prospect in barren ground, that is the reason why I do not think they have water, because they have not prospected sufficiently; whereas on the upper levels they had ore bodies. They had to go through barren ground, in which they met with pockets of water. Consequently they had water. All the water in the Comstock, in my way of thinking, is derived from the surface. I wish to state, therefore, that if there are a great many dry seasons in succession, there will be less water in the mines thereafter.

Q. Is not all the water which is found going down to the Carson river derived from the surface?

A. That is what I have just stated.

Q. Would it be likely that there would be as much water found at the end of those dry seasons as there would be in a wet season?

WITNESS. Near the surface?

Mr. SUTRO. At any point.

WITNESS. There would be less water, but it takes some years for that water to penetrate to that depth. A few seasons only would not make a very material difference at a great depth. It might, close to the surface; it would certainly make some difference.

Q. Suppose this tunnel to be constructed, and these shafts which now exist connected by bore-holes with the tunnel; would not that drain off all the water?

A. It would drain off all the water of those water cham-

bers with which it was connected by these bore-holes or shafts.

Q. Would it not drain all the water that was in the shaft?

A. Yes, sir; certainly.

Q. Would it not drain all the water that flows into the shaft?

A. Certainly.

Q. Could that water be economized by being carried down pipes, and used to drive water-pressure engines at the tunnel level?

A. Yes, sir, unquestionably.

Q. Have you ever seen that done in the mines?

A. Yes, sir.

Q. Is it not done in every mine where miners work intelligently, and where they have been able to make an adit?

A. So far as I know it is, and there are lots of records to show it.

Q. Could that water power be employed for pumping the water from below the tunnel level?

A. Certainly, just as well.

Q. Could it be employed also to hoist the men and lower the men—to hoist them up from below the tunnel level?

A. It could be employed for that purpose.

Q. Could it not also be employed for the purpose of condensing the air, and driving it down into the lower levels?

A. Also.

Q. Would not that be a very economical power?

A. More economical than any that is being worked with there now.

Q. After the machinery was once erected, would there be much expense connected with the running of it?

WITNESS. Keeping it in repair, you mean?

Mr. SUTRO. Yes, sir.

A. Not a great deal.

Q. Would it not be comparatively a perfect trifle?

A. Well, it would be very small. It would not be compared to the present expenses of repairing and keeping machinery in order.

By the CHAIRMAN. Have you not already established all these facts by every witness that has been sworn?

Mr. SUTRO. We have a gentleman here who knows more about it than all the witnesses who have been examined thus far. He has been at these mines year after year. A doubt has been thrown upon some of these facts, and now I want to have them sustained by this gentleman, who has conducted mining engineering, and who has been employed there for years, and has had a vast deal of experience. His testimony is exceedingly important on this point.

The CHAIRMAN. Have not all the witnesses admitted that this water could be pumped out and used for a power for running the machinery?

Mr. SUTRO. They have; but it has been denied by the other side that it could be done, and consequently we desire to establish the fact by as many witnesses as we can.

The CHAIRMAN. It has not been denied by any witness who has been sworn, that I recollect of.

Mr. SUTRO. I do not know.

The CHAIRMAN. I think even Mr. Requa and Mr. Batterman swore to that; also Mr. Raymond and the commissioners.

Mr. SUTRO. Yes, sir; I believe they all did. Well, I will leave this matter about the water power.

The CHAIRMAN. Then, if they all swore in that way, I think you have pretty well established the fact.

Mr. SUTRO. Yes; but you cannot present facts too strongly here, in view of the opposition we have to meet. The parties who oppose us have denied statements which have been established a thousand times.

Mr. SUNDERLAND. I wish still to dispute this claim, Mr. Chairman; and if you think it is proper, they ought, perhaps, to be allowed to introduce any proof they may have

on the subject. I do not want Mr. Sutro choked off in regard to any matter.

The CHAIRMAN. I simply made a suggestion to save time, but if he wishes to go on and introduce further testimony on this point, very well.

Mr. SUTRO. I will consume very little time, Mr. Chairman. In fact, I will drop that question right here. I want to ask the witness now whether it is not considered that the tunnel level opens up a new base of operations in the mine?

A. I think so.

Q. Do you commence entirely new operations in going down?

A. Well, in opening an adit level in a mine. We have a great many different methods of working the mine. You have better methods of working the mine. An adit level offers a great many facilities to work a mine, which a vertical shaft does not.

Q. When you open an adit level, you don't count, as a general thing, the depth of any mine from the surface; but you count from the adit level in technically speaking of mines. For instance, if that Sutro tunnel was run in there, it would cause all those mines which were down below the tunnel level to count from that level downward.

A. The ores from all the upper works could be brought to the surface at less expense through the tunnel than they could through shafts.

Q. It would open, as you say, a new field for operations.

A. An entirely different one from what we had before.

Mr. SUTRO. In order to arrive at another question in regard to that, I will read from a little work called Britain's Metal Mines, by John Robert Pike. He states—

"The depth of a Cornish mine is usually estimated in fathoms, and if a mine be stated as forty fathoms deep, it is understood that the depth is reckoned below the adit level, and not from the 'grass' or the shaft's mouth. The adit is the highest level in a mine, and has many practical uses. In the great majority of cases they are driven from a valley into more elevated ground, with the primary object of intersecting the sett, so as to afford a starting point for regular working, and in order to ascertain the particular character of the strata and lodes. The adit is useful as a means of ventilation; it receives the water from the pumps, and, in some instances, the stuff from the 'kibbles,'

or buckets. It is obvious, therefore, from what we have stated, that the depth of any adit from the mouth of a shaft must altogether depend on the position of the latter. Every mine has its adit level, and some have two—respectively called the deep and shallow adits; but the largest work of this description, and which partakes, to some extent, of a public character, is the 'Great Adit,' which receives the waters of a great many mines in the Gwenap and Redruth districts, discharging through a valley into the sea near Falmouth. This adit, including its ramifications, measures about thirty miles in length, and its greatest depth below the surface may be estimated at about seventy fathoms."

Q. They always construct adits?

A. So far as I know they always do.

Q. They mean by an adit a tunnel?

A. Yes, sir; a tunnel is called in England an adit.

Mr. SUTRO. That is the English term. Our American term is tunnel. The Spanish is socabon.

Q. Well, then, in running this tunnel in, it would be very desirable that these shafts which now exist should be connected with that tunnel level?

A. I think so. In fact, that is the first work to be done that they should be connected.

Q. Do you know about the heat in these mines—have you ever been in very hot places?

A. Yes, sir.

Q. How hot was it in any place where you have ever been?

A. I never measured it but once, and that was 105°.

Q. Do you think there are any places hotter than that even?

A. Yes, sir.

Q. How hot?

A. I could not state, because I did not measure it.

Q. Do you think it was as hot as 120° in any place? Do you think it is as hot anywhere?

A. I think it must have been hotter than that.

Q. How much work can a man do in a hot place like that, compared to a good atmosphere?

A. Well, he certainly could not do near as much. I do not think he could do one-half as much.

Q. Now, suppose that a tunnel were run in, and lateral drifts extended, and shafts sunk down every 1,000 feet

on that lode, connecting with the tunnel, would it not be very easy, then, to make drifts connecting these shafts again at every level?

A. Certainly.

Q. Would not that ventilate those mines to such a degree as to reduce the temperature?

A. If you do distribute the quantity of air—the bulk of air that goes through the tunnel—if you distribute that through all these apertures, you won't derive much benefit from it.

Mr. SUTRO. You don't appear to understand my question.

Mr. SUNDERLAND. Yes, he does perfectly, and has answered your question.

Mr. SUTRO. I will put my question in a plainer form. I have asked you, provided there be 22 shafts sunk on the Comstock lode, down to the tunnel level, one every 1,000 feet, and drifts were made between these shafts, connecting one shaft with the other, every 100 feet going down, whether the ventilation that would be created by that going through these drifts would not cool the atmosphere to such a degree that the capacity of the men would be largely increased?

A. Certainly.

Q. I understood that you wished to derive all the air for ventilation through the tunnel?

A. No, sir; not all the air. That would be only a portion of the air coming through the tunnel.

Q. I mean to say that, provided all these shafts were made as I have stated, and a thorough ventilation brought about in the manner I have described, would not that cool the atmosphere to a very large extent?

A. Yes, sir.

Mr. SUNDERLAND. I will ask you, did you state this would thoroughly ventilate the Comstock—this tunnel?

Mr. SUTRO. I have not come to that question yet.

Mr. SUNDERLAND. He has presupposed that the witness had answered the question. Now, I submit, it is not fair to

the witness, nor fair to any body, to go upon supposition. Mr. Sutro describes a mode of thoroughly ventilating the whole Comstock, when the witness has stated directly the contrary; that there would not enough air pass through the tunnel, if it were distributed through all the openings and apertures in the Comstock, to be of any considerable benefit. Now he goes on and supposes—

Mr. SUTRO. You will have a chance to examine this witness when I get through. I do not want to be interrupted.

Mr. SUNDERLAND. Now he goes on and says the Comstock shall be thoroughly ventilated as he describes.

Mr. SUTRO. I will presently show how much value is to be attached to the statement.

Mr. SUNDERLAND. I propose to have this question decided now by the committee. I don't like to see a witness misled, (and I think he is being,) because I do not think Mr. Luckhardt wishes to say that this tunnel will thoroughly ventilate this mine.

Mr. SUTRO. I do not wish to be interrupted. Mr. Sunderland will have a chance to examine this witness on all these points. He wants to draw out an answer from this witness that the witness does not want to give. He don't understand the question, and Mr. S. is trying to take advantage of that.

The CHAIRMAN. State your question to the witness.

Mr. SUTRO. He has answered it. I was trying to show this: that, if this tunnel is constructed, it will be possible, then, to make a great number of shafts along the whole lode, connecting them with the tunnel, for the simple reason that bore-holes may be made to let out the water, which will facilitate the construction of these shafts; consequently these shafts, which it is almost impossible to make now, on account of the expense, will all be made, in order to bring about a thorough examination of the Comstock lode. They are necessary, in order to explore the Comstock lode. After these shafts are constructed, it will be possible to drift from one shaft to another, commencing at both shafts, and meeting in the center, drifting 500 feet

from each shaft, and thus making connections between the two different shafts at every 100 feet, which will afford a thorough exploration of the mine. The question put to the witness was: Suppose we make all these shafts, and all these connections, whether that would not reduce the temperature; and he answered, "Yes." Now, I want to put another question, following that up: What do you consider an average temperature, in all the works of the Comstock lode, below 1,000 feet. Make a general average, as near as you can?

WITNESS. I cannot give you that.

Q. Do you think it would be 105°?

A. I do not understand your question.

Mr. SUTRO. My question is, what is the average of all the different drifts and works in the Comstock lode, below 1,000 feet, or at the 1,000-foot level? Take all the drifts that have been made.

WITNESS. Taking in this ventilation?

Mr. SUTRO. Yes, sir.

WITNESS. Oh, I cannot tell. I would have to guess.

Mr. SUTRO. Of course you would have to guess. Your statement about it, however, will be as valuable as any we have had, and probably a great deal more so.

Mr. SUNDERLAND. More compliments.

WITNESS. It would certainly be a great deal higher than it is on the surface. I cannot give any figures, because I may be 10° or 15° too high, or 10° or 15° too low.

Q. What is the average heat in these drifts where these men are at work?

A. In those places that are driven ahead, and have no out-let, the temperature ranges from 90 to 100 in a great many.

Q. Is it not higher than that in some places?

A. Sometimes it is.

Q. Often higher when the drifts are very long?

A. In stopes that have connections, (short connections,) the temperature is low. I have seen it as low as 70.

Q. At what depth?

A. On the 800-foot level of the Jacket.

Q. Is that not connected with Crown Point?

A. That was connected all through.

Q. Now, what is the distance between the "Yellow Jacket" shaft and the "Crown Point" shaft?

A. A little over 300 feet.

Q. That is the very point I want to get at. Suppose there were shafts all along the lode, and they were connected like the Crown Point and Yellow Jacket are, where there is a strong draught and the temperature has gone at once as low as 70° , whether that would not bring about the same condition of affairs all along the lode?

A. If you take the air from one shaft down the drift, and produce an artificial current, you can, through these drifts, and to all those shafts of which you speak, to the best of my knowledge, ventilate that entire ground thoroughly.

Mr. SUTRO. That is precisely what I want to get at. My question was, would not that reduce the temperature down to 70° ?

A. That I could not say, because the temperature at 2,000 feet is a great deal higher than it is at 1,000. The drag of the air, in going up from 2,000 feet, on the surface is much greater than from 1,000.

Q. What I want to get at is this: Suppose such a perfect system of ventilation would be brought about as could be brought about after these shafts have been put down; I want you to state whether the atmosphere in those mines would not cool off, to a very large degree, say after a year or two?

A. Unquestionably.

Q. That is what I desired to know. If you reduce the temperature to 70° , would not the capacity of the men be doubled?

A. I do not know that it would be exactly doubled. Men would work to greater advantage and do more work, but I do not know whether it would be doubled.

Q. How much more would they do?

A. Men, when they are working in the temperature of

70°, I think, can do twice as much work as when they work in a temperature over 95°.

Q. That would be double?

A. Yes; but I do not know whether you would get that temperature down to 70°.

Q. You say it had already been reduced down, in the Yellow Jacket mine, to that temperature?

A. Yes, sir.

Q. Suppose the same condition exists at other mines, would not it be reduced to the same temperature too?

A. If you produce the same conditions.

Q. It has been stated that they employed 3,000 miners, at \$4 per day, or an expense of \$12,000. Then they would save \$6,000 a day, would they not?

A. Yes, sir, at that rate.

Q. I want to ask you, now, what is the cheapest mode of transportation in tunnels, by locomotives or stationary engines?

A. When the work to be done requires four animals, and they can do all the work that can be done in a tunnel, that is unquestionably the cheapest method of transportation of ore; but when you can employ more and keep them at work, then machinery is the cheapest, and of all kinds of machinery I think stationary engines do the work the cheapest; and I will, at the same time, state that the further you work from an engine the cheaper, in proportion, will be the work which you wish to produce.

Q. Do you mean to say that the longer the distance you want to transport your ore over, the cheaper you transport every ton of ore per mile?

A. Yes, sir; you must not go beyond a limit, which limit is arrived at by a calculation of the strength of the rope and the material.

Q. But, then, it would be cheaper, say, for instance, to transport ore through a tunnel 4 miles in length, than it would through a tunnel 1 mile in length, for every 100 feet, do you know?

A. Yes, sir.

Q. Do you see any difficulty in putting in a stationery engine at the mouth of the tunnel, and having a wire-rope run in all the way?

A. That depends upon how wide your tunnel is, and how heavy you wish to run your cars. I do not see that there is any difficulty in placing a stationery engine there, and making it do the work of pulling out these ores.

Q. Could you transport a very large quantity in that way?

A. Yes, sir; but you would have to keep that engine constantly running—the cars going in, and coming out—because the benefit which you derive from that way of working is by never stopping your engine and losing time. Continually working makes the rate of transportation less in the long distance.

Q. Will you please look at this statement made by Mr. Carlyle, and see whether that is a fair statement of the cost? He gives the cost at 7 cents per ton for the 4 miles.

A. I have no reason to doubt that statement, only I think his fuel is a little too low; but I think his 5 per cent. per month for wear and tear is very high, so that would cover the deficiency in the wood question.

Q. You would consider that a fair statement, would you?

A. I think so; yes sir.

Q. Taking 3,000 tons a day to be transported—

WITNESS, (continuing his answer.) He cannot put that engine there with the rope for \$50,000. I do not know whether he can do that or not. I see he makes an allowance in this calculation for that, but if he can furnish all the ropes for \$50,000—

Q. Suppose it takes a little more than that, how much difference would it make. A cent's difference on a ton?

A. Yes, sir; and make a little over a cent, but in the neighborhood of a cent; I think that would cover it.

Q. Would 8 cents cover it pretty fully—8 cents a ton?

A. It might.

Q. Do you see any difficulty in taking ore down to the tunnel level by means of a double shaft, the car going down one side, with the brake attached to it on top?

A. No, sir.

Q. Do you see any difficulty in putting in a man-engine, or fahrkunst, to take the men up or down?

A. I do not see any difficulty, but I do not think it would be advisable, because the fahrkunst is an institution that goes very slow, but it is very safe. But these fahrkunst, of late years, have gone very much out of vogue. These same machines—the same power that would be required to drive the fahrkunst—could be employed in a better way to lower and raise men than by that means.

Q. Men could be sent up in empty cars?

A. Yes, sir.

Q. I want to ask you now about reducing ores. How much do the mines get from the mills?

A. I have heard various statements. I think, if my memory serves me right, that from 60 to 65 per cent. is assured by the mills to the mines.

Q. Suppose they do not get out 65 per cent., do they pay any reclamation?

A. That, as I understand, has always been the rule.

Q. Have you ever known the Union Mill and Mining Company to pay any reclamation?

A. I only know of two persons, with whom I happen to be very well acquainted, in Virginia, that have paid reclamations to mining companies.

Q. Mill owners?

A. Yes, sir, that had paid reclamations.

Q. Did they belong to the Union Mill and Mining Company's?

A. I believe not.

Q. Have you ever heard of the Union Mill and Mining Company paying any reclamations?

A. I never have heard that they did.

Q. So they do not seem to get out more than 65 per cent. of the assay value of the ore which is returned to the mines?

A. I think that a great many people there say that they get out 80 or 85 per cent., and I think, in some instances,

judging from the character of the ore found, that it is possible to get out that, but not as a general thing, because the ores of the Comstock are of such a nature that any man who knows the nature of the ores, or knows how to judge of ores, would consider it to be a preposterous idea to get out 80 or 85 per cent. by crude amalgamation. By treating those ores, by previous processes anterior to amalgamation, you may get out from 80 to 85 per cent.; but I think from 60 to 65 per cent. is the general yield of most of the ores.

Q. I want to ask you whether there is not from 35 to 40 per cent. of silver contained in these ores, in such combinations with the base metals—say lead, zinc, copper, iron, antimony, and even with sulphur—that cannot be taken out by common amalgamation? Is not that a fact?

A. Well, I won't say that 35 to 40 per cent., but somewhere near there. A certain percentage of that 35 or 40 per cent. consists of amalgam, which goes off with the tailings.

Q. How much do you think there is of this refractory or rebellious metal contained in those ores. What per cent. exists there that cannot be taken out by ordinary amalgamation, taking the average of the Comstock lode?

A. There is within 3 or 4 per cent. of that which is not gotten out; or, in other words, to make myself more explicit, suppose you get out 60 per cent. of the silver, there would probably be, by crude amalgamation, 35 or 36 per cent. of the silver in refractory ores, and the other 3 per cent. would be as very fine amalgam in the tailings.

Q. Then there would be, according to that, at least 35 per cent. of refractory ore or rebellious metal in those ores?

A. Yes, sir.

Q. Cannot that be taken out by amalgamation?

A. Not by crude amalgamation.

Q. Cannot they get out a little of that again by letting it lay exposed to the air?

A. Yes, sir; all that is required of those tailings is to

get silver in the amalgamable state, oxydize them, then all that portion which is oxydized will amalgamate.

Q. Now, suppose there were reduction works at the mouth of the tunnel—ordinary amalgamating mills existing there, which I believe use the most approved process for that class of ores—and suppose there were concentrating works attached to those mills, on an extensive scale and of the most approved plan, would it not be possible to take the tailings from those mills and run them through that concentrating machinery and get out to 90 per cent. of the whole ore; that is, of the original value of the ore?

A. I think so.

Q. Then would you not get, in that manner—in a concentrated form—this rebellious portion which cannot be obtained by common amalgamation? Could not that be put through a roasting and chlorodizing process, and 90 per cent. obtained again?

A. No; I think but 80 per cent. could be obtained.

Q. Will you please give us some figures now as to how much you would get then?

A. I made a calculation here on the low grade this afternoon. The ore, which assayed \$10 per ton—

Q. Will you please state what results you arrived at?

A. I arrived at this result: that, taking say 10 tons as the basis—I say that, by common amalgamation, \$60 out of 10 tons could be obtained—that would be \$60 out of the value of \$100, and the tailings could be concentrated to one ton, of the value of \$30, causing a loss of 10 per cent. in concentration. I think if steam power was used, that would cost \$5 10; and if water power was used, it would cost \$4 10; that would make a difference of \$1 between water and steam power. I mean as to the motive power. Then I say that these 10 tons or nearly 10 tons of tailings which you get, could be concentrated to 1 ton, at a cost of \$5, by these concentrating machines.

Mr. SUTRO. They would have \$40 in them?

A. They ought to have \$40 in them. Now, I allow 10.

per cent. loss in concentration. I will call that 1 ton, of the value of \$30—that 1 ton.

Q. That is 25 per cent., is it not?

A. That is 10 per cent. loss on the original.

Q. That is 25 per cent. on \$40, allowing a loss of 25 per cent.?

A. Yes, sir; if that was roasted and amalgamated, you could obtain at least 80 per cent.

Q. That would give you, then, a total gain, after paying all expenses of the first amalgamation, concentration, roasting, and second amalgamation—give you a margin of \$30, provided you pay \$60 for the ore?

A. Yes, sir; for the 10 tons.

Q. Do I understand you correctly now, that you take out first 60 per cent., and the next operation 30 per cent., that making 90, and the whole operation can be performed on \$10-rock, and pay even a profit?

A. Yes, sir; I think so.

Q. Now, supposing you take that rock and crush it first, then concentrate the ore itself, would it not still lessen the expense?

A. No, because you have to crush all the ores in the first place any way, in order to concentrate it. You are as likely to lose 20 per cent. in concentration as you are to lose 10. The higher the ore is in precious metals, the higher the loss in concentration; therefore I would advise one to amalgamate it first, and then concentrate the tailings.

Q. Supposing we had reduction works at the mouth of the tunnel—amalgamating works driven by steam; say we could get coal there at \$12 per ton, by making a branch railroad, and bringing in the coal from the Rocky Mountains there—suppose we have these reduction works driven by steam, would the tunnel, in your own opinion, furnish sufficient water to carry on this concentrating operation?

WITNESS. First tell me how much ore you wish to concentrate.

Q. How much water do you think would issue from that tunnel after its completion, and after its branches are

completed, and shafts connected with it? What is your opinion about that?

A. I would have to guess at that.

Q. Do you think there would be 10 cubic feet, at the rate say of 4 miles an hour? That would give 1,440 inches.

A. I think that less than half that you could depend upon.

Q. How much would that be? How many inches would you consider would flow out?

A. About 600 inches—600 miner's inches.

Q. Would that be sufficient, if you supply steam machinery to drive concentrating works, to concentrate say 1,000 tons a day?

A. No, hardly.

Q. Would it not be nearly enough?

A. I would not like to say.

Q. Suppose an additional supply was obtained from other sources, say from the Carson river, to make that 1,000 inches. Would that not be sufficient to reduce 1,000 tons of ore?

A. Yes, sir.

Q. Now, suppose those concentrating works, and those steam-mills, should be erected at the mouth of the tunnel; don't you think that we could pay the mine-owners 65 per cent. for their ore, without any charge for transportation or milling, and receive the ores right at the foot of the shaft—or at the mine?

A. I think you could pay 60 per cent.

Q. Take the \$40 ore—take the average of the ore.

A. I think you could pay 65 per cent.

Q. Then take say \$30-rock, with 5 per cent. off, that would be \$1 50 a ton, would it not?

A. Five per cent., at \$30, would be \$1 50 a ton.

Q. Then would not the mines yet save the whole cost of transportation and milling, which is given at \$12? Then deduct \$1 50, which would still save \$10 50 on every ton of ore to the mine. That would amount in a year,

with 365,000 tons at \$10, to \$3,650,000. Would not that be a clear saving to the mine of \$3,650,000?

A. If you make that arrangement with them, I do not see why it would not.

Q. It would be, if you figure the cost of reduction at what you figure it there—\$12—and that is counting steam machinery, not counting water power.

A. Yes, sir.

Q. Now, don't you think that quantity of ore extracted from these mines would be trebled after that tunnel is in?

A. I certainly think so.

Q. Then the saving would be three times that much—would be over \$10,000,000 per annum actually saved to the mine-owners?

A. Provided that could be worked. We were talking about working 1,000 tons, not working 3,000.

Q. Provided water be brought in there sufficient for concentrating purposes?

A. Yes, sir.

Q. It has been shown here by Captain Day, (Surveyor General of Nevada,) that the average flow of water on the Carson river, provided the water is stored up in the winter time, would amount to 508 square feet. Suppose you take off from that 508 square feet 20 square feet only, which is the twenty-fifth part; 20 square feet would give us 2,880 inches of water. That, in addition to what comes out of the tunnel—would that be sufficient for the concentration of all these ores?

A. Of 3,000 tons a day?

Mr. SUTRO. Yes, sir.

WITNESS. At the rate we figured before it would not.

Mr. SUTRO. It would be more?

WITNESS. No, sir.

Q. Then taking the 25th part of the water in that river, it would give enough water to concentrate even three times what is taken out now—or 3,000 tons a day?

A. I do not know whether that is the 25th part.

Mr. SUTRO. Yes, sir, according to the statement of General Day.

A. If you have that quantity of water you can certainly concentrate those ores.

Q. Then, to repeat the statement. By erecting steam mills there, and large concentration works, and taking the 25th part of Carson river, it would enable us to pay 60 per cent. of the value of the ore, and take it at the mine, and work it to a profit?

A. I think so.

Q. The difference between using water power and steam power would not be a considerable item, in your opinion?

A. No, sir; it would be between 90 cents or \$1 on a ton. I made my calculation from the following: I took a 20-stamp mill, requiring 40 horse-power. I estimated the cost of the engine and boiler at \$10,000, and the wear and tear at 7 per cent. I then calculated that down to a day, which gives \$2 a day. I estimated 2 tons of coal a day to be \$24; I estimated the lubricating oil at \$1; two engineers at \$10, and a helper at \$2 50. That gave me an average of \$1 99 per ton for power for a 20-stamp mill, in which I could easily crush 20 tons of ore. On the other hand, I calculated a water power for 20 stamps, or 40 horse-power; allowing cost of the mill and dam at \$12,000, interest at 10 per cent. per annum, which makes \$3 33 a day; allowing 7 per cent. for wear and tear, giving \$2 33 per day. Three-fourths of a ton of coal for creating steam, \$9, and the labor of 1 man, \$2 50; making an aggregate of \$1 per ton, allowing still 15 per cent. for contingencies. That gave me \$1 against \$1 99, counting the steam I have to use in amalgamation. This only gives the power, but the steam for amalgamation I added to the water power, which gave us \$1 against \$1 99.

Q. If I understand you correctly now, in taking a steam-mill, you use the waste steam for heating your amalgamating pans, while in the water-mill you have a boiler, and make steam on purpose to heat the pans. Consequently, the water-mill cannot be run without steam?

A. No, sir; that is the reason I added the wear and tear of the steam-mill, and the boiler and the coal; and the labor to create the steam in the water-power mill.

Mr. RICE. But that is not for power at all—that steam?

A. Yes, sir; I added that to the power in the water-mill, because the cost of amalgamation afterwards will, in both cases, be the same.

Q. I will ask you whether you know of any single mill in that country there, that works ores from the Comstock lode, that does not use steam for amalgamation purposes?

A. No good mill.

Q. They all use steam?

A. Yes, sir.

Q. Consequently every water-mill has to have a steam-boiler, does it not?

A. Yes, sir.

Q. In order to supply the steam for these amalgamating pans?

A. Yes, sir.

Q. I want to ask you now what capacity of making steam a ton of coal from the Rocky Mountains has, as compared to wood? How does it compare with wood?

A. That coal from the Rocky mountains, you have reference to?

Mr. SUTRO. Yes, sir; does it equal 2 cords?

A. No, sir; I think that the Rocky-Mountain coal would be equal to $2\frac{1}{2}$ cords of wood.

Q. Then that coal at \$12 would be equal to wood at about \$4—a little over \$4 a cord? The coal at \$12 would be equal to wood at \$4, and a little over a cord?

A. Yes, sir.

Q. Now, I want to exhibit to you a map here of the working of the mines in the Harz mountains, in Germany, and I want first to ask you whether you have been at those mines at Claustahl?

A. Yes, sir; I have been at Claustahl.

Q. How long have those mines been worked?

A. Oh, they have been worked for a number of years. I do not recollect. They have been worked for centuries.

Q. Will you be kind enough to look at this map here, and at the scale that is given here, which is given in Lachter, and state what depth this shaft is—the George Wilhelm shaft? How much it measures in English feet?

A. 2,311½ feet.

Q. American feet?

A. Yes, sir.

Q. Now will you please state at what depth the Ernst August tunnel cut that shaft when they constructed it?

WITNESS. How do you mean?

Mr. SUTRO. This tunnel has only been completed within the last 8 years.

A. I do not know; I did not keep a record of it. I judge 1,297 feet.

Q. Will you please deduct that 1,297 feet from the 2,311, which would give us the depth that shaft was below the tunnel level when that tunnel was made?

A. 1,014 feet.

Q. Below the tunnel level?

A. Yes, sir.

Q. You say that extensive works below that tunnel level are in existence there?

A. Oh, yes, sir.

Q. Will you be kind enough to measure the depth between the deep George tunnel, and the Ernst August tunnel?

A. 400 feet.

Q. The deep George tunnel is stated here in the books to be 6½ miles in length; and the “Ernst August” tunnel is given at 14 miles in length. Then, according to this, this tunnel 14 miles in length was constructed to gain an additional depth of 400 feet. Is that correct?

A. Yes, sir; to get a depth of 400 feet lower than what they had already.

Q. They had a tunnel in existence 6½ miles; and, in

order to get 400 feet deeper, then constructed a new tunnel 14 miles in length?

A. Yes, sir.

Q. So they gained 400 feet in pumping?

A. Yes, sir.

Q. And 400 feet in operating the mines by constructing that tunnel?

A. Yes, sir.

Q. What depth do they get on the Comstock lode by running this tunnel in 4 miles?

A. 2,000 feet.

Q. Now, I want to ask you whether the mines in the Harz mountains are worked with intelligence?

A. The government always employed the scholars directly from the mining schools, and they were taken in rotation, if they made application to the government for positions. Of course, the government was connected with these mining schools, and the government was interested in the mines; and it was for the government's interest to get the most intelligent managers that they could at those mines.

Q. Is any one employed there in charge of those mines who is not a thorough-going engineer, and a scientific man?

A. I do not know of one.

Q. Are they not practical men?

A. They become practical men from the mining course they have to go through.

Q. And don't they have to go from one stage to another before they get to the top of the ladder in position?

A. Yes, sir.

Q. They have to go through all the different stages, commencing first as a common miner, do they not?

A. No, sir. In the mining school, where he receives his tuition, there are certain days in the week when he has to go into a mine, where he has to learn how to survey, not technically, but practically. He is shown all through the mine. He stands by the men and sees them work, and receives instruction and explanation. Then he is taken

out of the mines in the same way that the men get out. He is taken out, then, and shown how the ores are worked. In fact, everything that he learns there is taught first technically, and afterwards practically.

Q. What business are you engaged in now?

A. I have an office in San Francisco, California, as mining engineer and metallurgist, for the purpose of assaying ores, working ores, and amalgamating ores, and I sometimes buy ores.

Q. Have you an establishment for metallurgical treatment?

A. Yes, sir.

Q. Do not people send ores to you from all parts of the country, in order to arrive at the correct value of ores?

A. Yes, sir. That is what I depend upon for my work.

Q. And you apply the most perfect treatment, in order to arrive at the most correct result by practical working?

A. Yes, sir. It is our business to examine ores, and afterwards I take them and treat them.

Q. I want to ask you one or two questions now about the water power on the Carson river. I want to ask you, if there be a dam constructed say at the Franklin mill—a dam only 30 feet high—which would back up the water but a short distance, and that water taken out at that dam and carried near the mouth of the tunnel, which would give, according to General Day's statement, 100 feet of fall, and adding 30 for the dam, 130 feet, whether that would not give ample power to propel enough mills to reduce all the ore in the Comstock lode?

A. No, sir; I do not think it would.

Q. Suppose dams be constructed in the mountains, and the water accumulated there in the winter, and let down into Carson river, do you think that would give an ample supply by taking the water out under the circumstances I have stated?

A. I think it might, but I would not like to give an opinion on that, because I do not know the location of the

dam, and I do know the location of the mouth of the tunnel exactly, and then I do not know how much water there is in there.

Mr. SUTRO. We have these statements here communicated by General Day, and you not having gone into his figures, and it being late, it will take too long. I will not, therefore, go into this question again of figuring about this water power. If I should want to arrive at an intelligent result, I would have to submit the figures and let Mr. Luckhardt make his calculations, which will probably take another hour, and therefore I will close here.

Adjourned to meet on the 27th.

HEARING WEDNESDAY, MARCH 27TH.

Cross-examination of C. A. Luckhardt.

By Mr. SUNDERLAND:

Q. What was your first employment upon the Comstock?

A. In Virginia City my first employment was as assayer, with Paxton & Thornburgh.

Q. How long did you remain in that employment?

A. Three months, I think.

Q. Where were you next employed?

A. I was next employed as superintendent of the Justis.

Q. What year was that?

A. I am not quite certain whether it was the latter end of 1864 or 1865.

Q. What year did you go to Virginia City?

A. The same year that I was there as assayer.

Q. How long did you remain in the Justis?

A. I think it was six months.

Q. Did you get out any ore during the time you were there?

A. Yes, sir.

Q. Where was it milled?

A. It was milled in Mr. Weston's mill.

Q. What percentage was saved by the mill and returned to the mine?

A. Sixty per cent. It was on ore that I sent to test the quality of what I had in the mine. At that time the mill rate was higher than it is now, and I was trying to see if I could make that mine pay. I sent this ore, therefore, as a test. It was not the regular working of ore for the company.

Q. How much ore did you have worked?

A. I had 20 tons worked at one time and 50 tons at another, I think.

Q. Is that all the ore you had worked out of that mine while you were there?

A. Yes, sir.

Q. Did Mr. Weston pay you any reclamation?

A. I had an understanding with Mr. Weston at the time that he should not charge me any mill rate in case the ore did not pay, because the Justis Mining Company was then in rather poor circumstances, and I was trying, as superintendent, to do my best to reduce the expenditures. I did not, therefore, pay him the full price for the working of the ore; nor did he pay me any reclamation.

Q. Where was your next employment, and in what capacity was it?

A. I was engaged by the Ophir Company to act as superintendent.

Q. How long did you continue in that capacity?

A. I cannot tell exactly the number of months. I stayed there until Mr. Fair took charge.

Q. Was there anybody else in Virginia City, during the time you acted as superintendent, who had charge of any business in the Ophir?

A. The President, Mr. Blanding.

Q. He was there?

A. Yes, sir; the greater portion of the time.

Q. Was he not acting as superintendent himself?

A. I do not know. He gave me entire charge of the mine and all its appurtenances. He gave me charge of furnishing the mills with a certain number of tons of ore in a certain time and at a certain rate; and he gave me charge of all the men and all the expenditures. We had a secretary and superintendent. He limited me in one respect, as regards making contracts for the company.

Q. You attended to all the contracts?

A. The contracts which I gave out, were to take ore out of the mine and the old dumps. The mine was behind at the time, and the understanding between Mr. Blanding and myself was, that I should get his consent to those contracts.

Q. Didn't he direct to what mills the ore should be sent?

A. Yes, sir.

Q. Did he contract with the mills as to the rates to be charged, and what percentage should be guarantied?

A. He had already an agreement with the Washoe mill—that I did not order. The other mill we sent to was the Woodworth mill, belonging to the Ophir company.

Q. Who owned the Washoe mill?

A. I do not know who was the owner of it. George Atwood had charge of it, or leased it.

Q. Wasn't it the Ophir mill that he leased?

A. I believe so; but I am not certain who was the owner at the time.

Q. Did that mill ever pay any reclamation?

A. At the time I was in the Ophir it did not, to my knowledge; because Mr. Blanding had made the arrangement with Mr. Atwood, and I do not know what it was.

Q. Did you superintend the accounts in any way? Did you have any supervision of them? Did you see what entries were made in the books, or give any directions to the clerk employed by Mr. Blanding in the office there?

A. How do you mean? Did I give directions in regard to the payment of the men, how many men should be employed, and what should be their salaries?

Q. I do not mean that at all. That is the business of the foreman, I believe—to employ men and discharge them.

A. I gave directions to the foreman, not to the secretary.

Q. The business of the foreman is to have the time kept, which he returns to the office of the company. That is a thing with which the superintendent has nothing to do.

A. Yes, sir.

Q. Now, did you take any charge or have any supervision of the books that were kept by the clerk?

A. No.

Q. You say you don't remember how long you remained there?

A. I do not remember. I cannot say. I knew that Mr. Blanding got my services, because he was troubled with a great deal of water on one of the mine levels, and his foreman and men could not stop it. He asked me if I was acquainted with building dams, and he spoke to Baron Richthofen, and Baron Richthofen recommended me to him; and that is the way I came to have charge of the mine.

Q. You say you left immediately after Captain Fair came in? Did I understand you to say that?

A. Yes.

Q. Where were you next employed.

A. I was employed by the Manhattan company in Austin. I was superintendent of their mills and their mines. They were the New York company.

Q. Was Mr. Curtis there at the time?

A. No, sir.

Q. How long did you remain there?

A. I think it was two months. The mine stopped on account of indebtedness. I do not recollect how long it was.

Q. What year were you there?

A. I think it was in the beginning of 1866.

Q. When were you superintendent of the North American?

A. When I returned to Virginia City.

Q. After you had been to Austin?

A. Yes, sir.

Q. How long were you there?

A. I was employed by the Bank folks, and at the same time I had the superintendentship of the North American.

Q. What time in 1868 was that, or was it in 1867?

A. I think it was in 1866. I forget the month. I had been employed by the Bank some six or eight months, may be a year, when I took charge of the North American.

Q. Did the North American ever yield any ore?

A. Not at that time. It had not been worked for a number of years, and I reopened it. I developed some low-grade ore there; but it wouldn't pay at that time.

Q. It has paid since, I believe, has it not?

A. Yes, sir; some.

Q. Is it being worked now?

A. I could not tell you.

Q. Don't you know it has been worked for the last two or three years?

A. I couldn't say.

Q. Don't you know that Mr. Hobart has been working it some time?

A. I don't know where Hobart worked. He took out some ore, I believe, between the Overman and the North American, together with Hamlet. I don't know where he took it from.

Q. Did you ever have any connection with any other mine there?

A. No.

Q. Now, I understand you to say that you were employed by the Bank of California as a mining engineer. What were your duties under that employment by the Bank of California?

A. My duties were to go into the mines, examine them, and make a report as regarded the quality of ore in sight and the prospects of the mines. These were my instructions for the first year or year and a half; but as that took a good deal of time and a good deal of writing, I was afterwards asked to make concise daily reports to the same purport.

Q. Cannot duties of that kind be performed by a man who is not a mining engineer?

A. A man who is not a mining engineer cannot very well have an opinion as to where ore may be found.

Q. You think a mining engineer can tell where ore can be found before it is found?

A. In some instances he can. He can calculate as regards the quantity that he sees and the quality, more or

less, by looking at it. But a man who is accustomed to mines there, possibly might fill the same position as regards the quantity that is in sight, and such a man could probably have filled the position I did.

Q. Do you know of any better judges of the quality of ore, or the prospects of a mine, than the man who uses a pick and shovel in the mine—the common miner, who works in the mine and assorts ore?

A. Decidedly: every mineralogist is.

Q. Did you ever know any instance on the Comstock where any body of ore was discovered by a mining engineer?

A. As mining engineers do not generally go into the mine with a pick and shovel, it is the man that does the actual manual labor that discovers it.

Q. Don't you know that Major Gillis, who is not a mining engineer, was employed in the same capacity by the Bank of California, long previous to the time that you were?

A. I heard so—yes, sir. I do not know it for a certainty.

Q. During the time you were employed by the Bank of California, did you ever operate any in the stocks of the mines that you were in?

A. I operated, after having been there over two years, on my own account, without connection with anybody else, because the injunction put upon me verbally, by the Bank of California, was to keep whatever I saw—all the knowledge which I gained through having access to these mines—to myself; not to make it known to anybody else; and for that reason I was very careful how I speculated, for I had given my word as a man, and I think I always have kept it.

Q. You suggested here a great many improvements that might be made upon the present mode of mining on the Comstock, I believe, did you not, last night?

A. On the working of the mines?

Q. The mode of working the mines.

A. I expressed an opinion in this regard that I thought

the opening of a new tunnel—an adit tunnel—would be a great benefit to these mines, and would open up a new area for working. It would make mining there easier than it is now. I did not suggest anything; I merely alluded to it.

Q. Didn't you speak of using water for compressing air to send down into the mine?

A. I was asked whether water could be used for that purpose, and I believe I answered yes.

Q. While you were in charge of any mine upon the Comstock, did you make any change in the mode of sinking the mines you were in charge of?

A. I was the first one to introduce the safety-cage on the Comstock.

Q. You were?

A. Yes, sir.

Q. Didn't Mr. M—— use it in the Potosi mine before you suggested it?

A. No, sir.

Q. What kind of safety did you use?

A. I used the old English safety-cage, which is on the principle of the common ice hook. It is the same as they use in England.

Q. It isn't used on the Comstock now, is it?

A. No, sir. I had that in the Justis mine the first one.

Q. Do you call the Justis a part of the Comstock?

A. Yes, sir.

Q. What evidence have you of that?

A. I have got the same west wall, I have got the same character of ore, and I have the same east wall. I see a great similarity in the manner of occurrence of the ore, and I believe I have no reason to doubt that it is a part of the Comstock.

Q. How far is the Justis from any other mine known and conceded to be a part of the Comstock?

A. Some people concede that the Overman is a part of the Comstock and the North American, and others concede the contrary; but they all, I believe, agree that the Crown Point and the Belcher are part of the Comstock; and that

would be a distance of I couldn't say how many feet. I should have to guess at it. It would be certainly nearly a mile.

Q. If the Overman and North American are a part of the Comstock, can it be possible that the Justis is a part?

A. Yes, sir.

Q. How so?

A. Because we know by analogy that a vein may split just as well, as it may have a fault.

Q. Well, then, you concede that the Justis is not upon the same fissure that the Overman is?

A. I do not know what you mean by the fissure. You may not understand the meaning of a fissure as I do.

Q. Explain it, then, as you understand it.

A. I think that the Justis is the out-runner or a spur. That may not be the technical term. I do not know the English for it; but just as the Overman is a part of the Comstock, so I consider that the Justis is a part of the Comstock.

Q. That is a matter of theory, and not a fact demonstrated?

A. No, sir. It would be demonstrated by our actual inspection of it, by running a drift into the lead, and seeing that the same vein-matter that we find in the Justis goes into the Comstock, and at the same time trace it from the Overman into the Comstock.

Q. How long since you were upon the Comstock to examine any mine?

A. Two years, I think.

Q. Ain't it three?

A. Two.

Q. Only two? Will it be three next May?

A. I think it is nearer two than three.

Q. To What depth had any mines been worked when you left there?

A. Well, I couldn't give you the figures exactly, although there is not a drift that was not, as I may say, photographed in my mind. For two years I never thought about the Com-

stock any more, never bothered about it, never have given it any attention, and the figures have escaped my memory. I might tell you 100 feet higher or lower; I couldn't give you the figures any more exactly. If I were to run over my old reports and study them up two or three days, I would then be able to give you all the figures of all the drifts and all the depths.

Q. Do you think any of them were 1,000 feet deep when you were there?

A. Oh, yes.

Q. What mines?

A. The Crown Point was 1,000; that I recollect. First let me ask you from where you wish me to start—from the croppings?

Q. From the top of the shaft.

A. The Crown Point, Bullion, and Norcross may have been that, but I won't be certain; I wouldn't like to state.

Q. Were you in the habit of visiting the Norcross while you were in the employment of the Bank of California?

A. Yes, sir.

Q. All the time?

A. Not all the time. I visited the Norcross quite a space of time after I was employed by the Bank of California, not at first; and then I visited it for a great number of months; then I was refused admission, and I visited it no more.

Q. You were asked last night if you knew what object the bank had in employing a man to examine the mines and report upon them?

A. Yes, sir.

Q. Do you not know that the bank was in the habit of loaning money to these mines to prosecute any work?

A. I do not know it. I have heard that said. I know it by report.

Q. You also said, in connection with reclamations, that you never knew of the Union Mill and Mining Company having paid reclamations; and in that connection you stated that the Union Mill and Mining Company belonged

to, or was controlled by, parties interested in the Bank of California.

A. I didn't say that I knew. I stated that I knew it from general report.

Q. Well, you stated that you never knew of their having paid any reclamations.

A. Neither did I.

Mr. SESSIONS. Mr. Sunderland, will you explain these reclamations?

Mr. SUNDERLAND. The mills guarantee a return of 65 per cent. of the assay value of the ore, as taken by the mining company; and if the return falls below 65 per cent., the difference between the actual return and the 65 per cent. is paid by the mill to the mining company as reclamation. (To the witness.) Did you occupy any such confidential position or relations with any mining company, or the Union Mill and Mining Company, as to be authorized to know anything about their business at all?

WITNESS. Of course not; neither did I say that I knew that they paid reclamations. I have only got it from general report, as I told you.

Q. And what is the general report?

A. The general report was that the Union Mill and Mining Company was composed of the same parties who had more or less control of the ores of the mines.

Q. I am not disputing that proposition at all. I am now talking about an insinuation that the Union Mill and Mining Company did not return the 65 per cent., and did not pay reclamations. What authority have you for saying that the Union Mill and Mining Company did not pay any reclamations?

A. I said they did not pay any reclamations, because I do not know of their having paid any.

Q. Then do you mean to say that you do not know whether they did or not?

A. That is it.

Q. You didn't state that last night?

A. That is the sense in which I meant it.

Q. You do not know that they paid any, leaving the impression that they had not paid. You were not in a position to know whether they paid reclamations or not, were you?

A. No.

Q. You were not in a position to demand access to their books or to anything about their business?

A. No, sir.

Q. When were you connected with any mine, that you had any right to know the business relations between it and the mill company?

A. I never was.

Q. Is it usual for a corporation or an individual to expose its or his business to a man who has no connection with the company or the individual?

A. That is at the option of the individual, I believe.

Q. It ain't usual for a good business man to go round and tell what his business is and what he is doing?

A. I cannot say whether it is or not. It is left to the individual.

Q. What salary did you get while you were employed by the Bank of California?

A. \$225 a month.

Q. During the time that you were employed by the Bank of California, did you ever tell Mr. Requa, superintendent, and Mr. Donnelly, foreman of the Chollar Potosi mine, that the Sutro tunnel was a humbug?

A. No, sir.

Q. Certain of that, are you?

A. I am certain of that.

Q. Haven't you told them so a great many times, while in the Chollar mine, in the presence of both?

A. No, sir.

Q. Haven't you denounced the Sutro tunnel as a humbug?

A. Not that I know of. I don't think that I ever spoke with Mr. Requa or Mr. Donnelly about the Sutro tunnel in my life, because the Sutro tunnel project was an arrange-

ment of which I knew hardly anything; and it was stated while I had so much to do in examining mines that I always minded my own business, and I always had the name of minding my own business, and never meddling with anybody else's business. I was very friendly to Mr. Requa and Mr. Donnelly, but I did not know anything about the tunnel, and I do not think I ever in my life made any such an assertion as that.

Q. You mean to say you never knew of but two mining engineers to be employed in the capacity of superintendent on the Comstock?

A. That is what I said; yes.

Q. Those were Mr. Janin and Mr. Bonner, did you say?

A. I didn't mention any names, but those were the ones. I believe they were educated in that capacity.

Q. There are no mining engineers on the Comstock now, are there?

A. I do not know.

Q. Were there any there when you left, employed as superintendents of the mines?

A. No, I believe not; not to my knowledge.

Q. Do you know why they were not continued there? Do you know why those mining engineers were not employed more generally, and, when employed, why they were not continued?

A. No, sir. I know that Mr. Bonner was employed all the time, and that he left his position twice, and I believe took charge again after an absence of some time. I do not think that the other gentleman needed to be employed, as he had other business.

Q. Mr. Janin?

A. Yes.

Q. Don't you know that he made a failure of his administration of the mine?

A. I do not know anything about his business, Mr. Sunderland, I never inquired into it.

Q. Wasn't Mr. Palmer a mining engineer?

A. Mr. Palmer was not employed in any mine, to my knowledge.

Q. Were you not there when he was superintendent of the Ophir?

A. No, sir; I know Mr. Palmer very well. He is a perfect gentleman, and I have the greatest faith in and respect for his attainments and his age. I do not know his capacity. I do not know anything about it. I do not know, except from hearsay, that he was superintendent of the Ophir. I never saw him acting as superintendent.

Q. I understood you to say that the mines on the Comstock were worked for speculation and for the benefit of the stockholders. Was that your statement?

A. No, sir.

Q. What was it?

A. I forget exactly what the question was and what my answer to it was; but I did not say that.

Q. Give it as near as you can remember.

A. I couldn't say. I forget what the question was.

Q. Well, I will ask you now if that is the case?

A. I couldn't answer that.

Q. Cannot answer it?

A. No, sir; because I do not know.

Q. I understood you to say that there was no mine or lode anywhere in the world so valuable as the Comstock.

A. No. I may have worded a sentence in such a way that that construction might be put upon it; not being as well versed in the English language as you are, but I did not intend it.

Q. Nobody wants to place you in any position, Mr. Luckhardt, that you are not willing to place yourself in. If you want to make any correction, make it at any time.

A. The sense I wanted to convey is this, Mr. Sunderland: that I thought there was no mine in existence that had yielded in so short a time the amount of money which the Comstock has yielded; and that is my true belief.

Q. Isn't that in great part owing to the energy with which it has been worked?

A. It is, it is true, owing to the energy and capital employed there, and it is also owing to the richness of the ore that has been found there; and I think the last is the main item of it.

Q. Are there any mines in Mexico and South America that have yielded vastly more in the aggregate than the Comstock?

A. Oh, yes; there was the Potosi mine, that has yielded five times as much.

Q. How much have the Potosi and Bolivia yielded?

A. I do not recollect. I happened to recollect the other, because I read in Humboldt a memorandum about it. The Potosi is known as one of the oldest mines, and it has yielded very largely. I forget the sum. I think it was £120,000,000 sterling.

Q. That was up to about 1800, according to my calculation?

A. That was up to 1842.

Q. Now, what mines in Mexico have yielded a larger sum in the aggregate than the Comstock? Any?

A. I do not know. There are very rich mines in Sinaloa that have yielded for years and years, but they kept no record of their mines there; they are generally fighting; and nobody can keep track there of anything.

Q. You say that low-grade ores are left in the mines on the Comstock, which cannot at present be worked, owing to the expensive mode in which the working is done?

A. I believe so; yes, sir.

Q. Is there any change that you would suggest in the mode of working the ores from the present method?

A. That question is too indefinite. I cannot answer it. There are three questions connected with it. I might suggest an improvement.

Q. What improvement or improvements would you suggest in the present mode of working?

A. I think it would be an improvement to crush those ores finer than they have been in the habit of crushing them, to amalgamate them in the same way that they are amalga-

mated now, and concentrate the tailings by the most improved methods of concentration, of which there are a great many, and take the concentrations and treat them in such manner as the character of the ore requires, so that you can get at the precious metals that are contained in them.

Q. By tailings do you mean what we designate as tailings, or do you include slimes, which pass off?

A. I term tailings everything but the amalgam.

Q. Everything that leaves the mill?

A. Everything that leaves the mill.

Q. Do you know whether any attempt has been made to work the slimes without drying them?

A. I won't be certain; but I believe Janin tried it; but with what results I do not know. He was experimenting a good deal, and he probably did not like to communicate to others the experience he gained.

A. Do you know whether he experimented for the Gould and Curry Company, while he was there?

A. No. At the time of which I speak he had a mill of his own below the Gould and Curry.

Q. He sold that, didn't he?

A. I do not know.

Q. Hadn't he parted with it when you left there?

A. I do not know.

Q. Do you know of any success in working slimes from the Comstock ore in any manner except by drying?

A. I do not think it has ever been tried sufficiently round Washoe to get at any result.

Q. Well, you can state whether you know of any one instance where there was a successful trial, can't you?

A. I do not know that anybody ever was successful.

Q. Don't you know that they have been worked successfully by first drying them and then simply amalgamating them in the pan?

A. I have heard so; yes, sir. I do not know.

Q. Was not Mr. Park working successfully when you left there?

A. I do not know what he was doing.

Q. He was running a mill, wasn't he?

A. I do not know anything about his business.

Q. Do you know whether he was running a mill or not?

A. No, sir; I do not.

Q. Ever pass up and down the cañon there close to Mr. Janin's mill, and see another mill running there—a tailings mill—below the Gould & Curry?

A. Yes, sir.

Q. Whose mill was that?

A. I do not know whose that was.

Q. Do you know anything about Birdsall's mill as a tailings mill at Dayton?

A. No.

Q. You speak of these immense quantities of low-grade ores. In what part of the Comstock are they?

A. They are in the Succor, Lucerne, Justis, North American, Overman, and that ground between the Justis and the Belcher. The names of the little companies I do not recollect. Up the hill there are two or three small companies, of which I do not recollect the names. Then I think there are low-grade ores in the Belcher.

Q. I will ask you, in reference to those you have already named, what benefit would the Sutro tunnel be to them?

A. The Sutro tunnel would be a benefit to them in this respect: after it is connected these ores can, in my estimation, be taken out through it with a profit. I think that that can be done in some day to come. It may not be possible now. I do not think that these ores ever will be taken out without they are taken out through a tunnel of some kind.

Q. You think they never will be? Do you know whether they are at work on the Succor?

A. I do not know.

Q. The Lucerne?

A. I do not know.

Q. The Justis?

A. I do not know whether they are or not.

Q. Did you ever hear it was proposed to extend the Su-

tro tunnel down to these mines? Did you ever hear a proposition of that kind made?

A. No. You asked me what benefit the Sutro tunnel would be to it.

Q. Well, if you never heard of the Sutro tunnel going there, how can the Sutro tunnel benefit these mines?

A. There is no reason why the tunnel should stop at the limit set for the extension of its drifts. There is no reason why the tunnel should not be extended 1,000 feet north or south, or a mile north or south, if the tunnel is in there. In my estimation it will certainly be done. The tunnel cannot be of any benefit to these mines unless connected with them.

Q. So far as known, the ores in the Succor, Justis, Lucerne, North American, and Overman are at or near the surface, are they not—those low-grade ores?

A. As far as I know those I have reference to. How far down they extend I do not know.

Q. Could you connect the Sutro tunnel with the surfaces of those mines, so as to make it profitable to let that ore down on to the level of the tunnel; and, if so, I want to know how you are going about it?

A. You asked me in a general sense if the tunnel would ever be of any benefit to those ores. I answered you yes.

Q. I want to know in what way.

A. I believe that these ores, and ores that will be found below them will be taken out through that tunnel when it is connected. How to make it profitable now I couldn't say; I couldn't make those ores pay now anyway.

Q. Anywhere?

A. No; you can't make them pay.

Q. Suppose you had the tunnel, could you make them pay?

A. If you had the tunnel connected, and had the improvements of which I have spoken, and to which reference has been made, and the tunnel opened, I do not see why these ores could not be made to pay; because, in

my estimation, when the tunnel is run and connected, this ore, which assays \$10 a ton, can be worked with a profit.

Q. Your proposition is, not to amalgamate the ore after first crushing. Which ores would you concentrate before amalgamation, and which after?

A. If I found ores of such specific gravity, (in the silver ore, or matter that comes with the ore,) as to allow of a speedy concentration, I would concentrate the ores at the start, then roast them and amalgamate them; thereby I would save a great deal more; but if the silver in the ores is in such a state—for instance, in the shape of polybasite or stephanite—where the specific gravity is not so great, why, then, I would certainly amalgamate the ores first, because the loss in concentration would not be so great.

Q. You do not pretend to say that we have got any stephanite in the Comstock, do you?

A. Yes, sir.

Q. Whereabouts?

A. It has been found from the surface all through the Mexican, Ophir, Gould and Curry, and Yellow Jacket. I took some out of the 700-foot level.

Q. Now, then, you say you would roast the ore at some stage?

A. Yes, sir.

Q. How would you roast it?

A. I would roast it by the most improved method; and the only one I know of is by the Stetefeldt furnace.

Q. What does it cost per ton to roast it by that furnace?

A. That all depends upon the cost of fuel. It costs from \$8 to \$10 a ton.

Q. You would have to dry it before you put it in the furnace, would you not? Can you handle wet crushed ore in the Stetefeldt furnace?

A. No, sir.

Q. Then, after you concentrate it, you have got to dry it?

A. You dry it in the dust chambers. That could be arranged very easily.

Q. That all requires handling—manual labor—does it not?

A. There are machines, elevators, that take these ores, without any manual labor, right out of the heap and carries them up.

Q. But after it is concentrated, how do you put it on to your chambers for drying? Do you do that by machinery?

A. Yes; I would take it after it is dried. I would have those elevators take it to the top of the furnace, and there is a machine made on purpose to feed that furnace regularly without any manual labor.

Q. When you estimate the cost of roasting in that furnace at from \$8 to \$10, what price do you fix upon fuel, and what kind of fuel do you use?

A. You can use coal or you can use wood in the Stetefeldt furnace, and the price of roasting is according to what you use.

Q. When you say from \$8 to \$10, what do you estimate the fuel to cost?

A. I estimate it to cost \$4 or \$5 a cord—wood. The cost of roasting, however, has not so much to do with the fuel as it has to do with the character of the ore. The richer the ore, the less you can feed; if the ore is poor in sulphur, the quicker you can feed. If the ore is very rich in sulphur, you would have to feed slower, because the ore is roasted by simply falling through a stack that is red hot; it falls through, and it has to roast while passing from the top to the bottom.

Q. If you have a good deal of sulphur in the ore, the sulphur itself helps, and makes the expense for fuel very slight?

A. Certainly; but then it is the quantity you could work. You understand me. If you only roast 50 tons in the furnace, of rich rock, it costs a *pro rata* per ton more than if you roast 100 tons of poor rock.

Q. I understand; but isn't the principal item of expense in roasting in the Stetefeldt furnace the fuel to make the heat?

A. Oh, certainly; there is none other, excepting the feeding machines.

Q. If you have a class of ores filled with sulphur, and the sulphur supplies the place of fuel, although the process may be slower, what is it that makes it cost so much more?

A. Because you do not put the quantity through.

Q. You said something last night about the bank loaning money upon stock, and getting proxies from the owners of stock, in order to control the elections?

A. I do not think I said that.

Q. What did you say?

A. I didn't say that the bank loaned money on stock, because I have no right to say so. I do not know.

Q. Then you mean to say now that you do not know anything about their having done that? Is that what you mean to say?

A. I said that I didn't say that they loaned money on stock.

Q. Then you do not know that they ever did procure proxies, or loaned money on stocks?

A. I know that a party came to me who was authorized, as I understood it, to get proxies in order to keep the then Administration in, and he asked me if I had stock, as it was for that purpose. That happened once or twice. As for their loaning money on it, I do not know.

Q. Isn't that a very usual thing, both in San Francisco and Virginia City, for different parties to go round and collect all the proxies they can get?

A. I do not know whether it is or not.

Q. You say the means of raising money by a mining company is by assessments and by borrowing. Is there any other possible means of a mining company raising money when they have got no ore in the mine?

A. No, I believe not.

Q. Did you ever know a mining company on the Comstock to fail to borrow all the money required for working

the mine, if they preferred that mode to making assessments?

A. I did not inquire. I do not know of any.

Q. You said that the difficulties of mining upon the Comstock are the want of ventilation, and the expense of hoisting ore and water. I believe that was your statement, wasn't it?

A. Yes.

Q. I will ask you first if you know what the size of the Sutro tunnel is to be?

A. I only know from what I have been told.

Q. Who told you?

A. I forget. I was told 14 feet by 12.

Q. Didn't Mr. Sutro tell you?

A. I won't say that he did. I have heard it.

Q. You do not know what the contract was between Mr. Sutro and the mining companies by the law of Congress?

A. No, sir.

Q. Nor the act which is now pending before Congress?

A. No, sir.

A. What size would it be necessary to make that tunnel, in order to answer the purpose for which it is proposed?

A. I think the size given would be large enough.

Q. How many square feet would a section of that tunnel give?

A. 14 by 12 multiplied—168 feet.

Mr. SUTRO. Then you have got to deduct the timber from that?

A. That answers the question.

Mr. SUNDERLAND. Suppose a tunnel were run in there with 100 square feet instead of 168, would that furnish sufficient air for ventilating the whole of the Comstock?

A. It all depends upon what portion of the Comstock you meant to ventilate.

Q. Well, I say the whole of it.

A. It is too indefinite a question. I cannot tell you that. You may have 1,000 drifts, and you may have 10,000

drifts; and if you take that quantity of air and distribute it into 10,000 drifts, of course, it would not be sufficient. If you had but 1,000 drifts, it might.

Q. You consider the Justis on the Comstock?

A. Yes, sir.

Q. And the Lucerne?

A. I consider that a part of the Comstock.

Q. How far was that from the Sierra Nevada?

A. As near as I can come at it, it was about 23,000 feet, because it runs in a crooked line, the way these measurements are taken.

Q. That is, from the Lucerne to the Sierra Nevada? That was my question.

A. I thought you said the Justis. The Lucerne would be 2,000 or 3,000 feet farther.

Q. Well, that is almost 5 miles is it?

A. Yes; but not quite.

Q. Now you understand what I mean by the whole Comstock. Suppose you had this tunnel in now, with a section of 100 square feet, would that give you air enough to ventilate the whole of the distance from the Lucerne to the Sierra Nevada?

A. If the tunnel were simply run in there, or if it were connected the way it is proposed by these shafts, do you mean?

Q. I am ignorant of how it is proposed. I do not know what the proposition is. I will get you to explain it. What is your proposition now to ventilate?

A. To ventilate all that ground would require at least a number of shafts at convenient distances from each other, along the Comstock and connected by drifts, and these shafts also connected with the longitudinal drifts running from the tunnel, then the tunnel would furnish a certain quantity of air, and these different shafts could be connected in such a way with the addition of artificial ventilation as to cause thorough ventilation of the entire work; but I do not think that all the drifts on the lode would all require to be ventilated at one time.

Q. What distance apart would it be necessary to sink these shafts along the line of the Comstock?

A. If you wish to ventilate the entire length, you would have to sink these from 1,000 to 1,200 feet apart.

Q. Wouldn't that be a very heavy expense through the barren part of the Comstock?

A. These shafts, if you would start in with this sole purpose in sinking them, would cost more than if you would make them during the progress of working, because they could be made of portions of the stopes, and the old workings. You wouldn't need to penetrate the entire mountain and run them all in a bee-line.

Q. Do you know of any shaft, or drift anywhere in the Comstock that has remained in place any considerable length of time without constant repairs?

A. Where ventilation was good, it has. There is the shaft 60 feet southwest from the Crown Point shaft. That shaft is 300 feet deep; and was as good when I saw it last as the day that it was made.

Q. What was that?

A. That was the shaft which had no name. It was not in use then.

Q. Hawkeye, wasn't it?

A. No; I forget.

Q. What shaft did that connect with to ventilate it?

A. It connected with the Crown Point mine.

Q. Don't you know that all these shafts on the Comstock, in fact, have to be repaired two or three times a year, on account of the swelling of the clay through which the shaft is sunk?

A. It is not the clay alone that makes repairs necessary. Wherever they are run through clay, they need repairing oftener than two or three times a year.

Q. How often do they require re-timbering, or timbers absolutely taken out and new ones put in, through the clay?

A. Very frequently.

Q. For what reason is it necessary to repair often?

Mr. SUTRO. Mr. Sunderland, I do not see what that has to do with the tunnel, whether you repair the shafts or not.

WITNESS. There is a natural sagging of the wood in such a long distance, where they are framed together, and that makes repairing necessary. Imperfect ventilation very often causes wood to rot quicker than it would if thoroughly ventilated.

Mr. SUNDERLAND. Well, now, if this tunnel were in, and connected with these different shafts, as they exist on the Comstock, I want to ask you whether, in 12 months, without repairs, every one of those shafts would be so closed that not a particle of air would get through.

A. Any piece of a mine of course needs repairing, or it goes to rack and ruin.

Q. Is it not necessary, in the majority of the drifts in the Comstock, to re-timber and to keep the timbers from treading and the drifts closing up?

A. Yes, sir. When the drifts are run through material that swells, of course they need repairing, because wood will rot and must needs be renewed.

Q. Is it any unusual thing there to see timbers, before they have been in 6 months, and while they are apparently new, crushed all to pieces in the drifts?

A. Yes, sir; I have seen timbers 8 feet high crushed in 8 months, the absolute strength of the wood destroyed, fibre knit in fibre and telescoped.

Q. Last night, I believe, you described how these pockets or reservoirs of water were formed on the Comstock, did you not? If you did not, I will get you to state it now, how the water is held by these clay seams?

A. The fact of finding the water in pockets on the Comstock, and not universally distributed through the whole lode, made me think that it occurred in this wise: We have, as you well know, in the Comstock productive and barren portions, and the barren portions so far have been found in the majority, and one of the component parts of these barren portions is very easy of decomposition, or metamorphism, and as these barren portions are something that

has fallen into the vein, coming as I suppose from the eastern wall, these portions as they went had to travel with a great deal of velocity, and that velocity created heat, and that heat was sufficient to decompose the feldspathic porphyry and form clay, because the basis of clay is feldspar, and as they passed through the vein matter they got coated on all sides with clay, leaving of course at places some openings, or else the water would not have got in. The water penetrated either in these intersections or surrounded them, wherever it formed two of these clay seams joined together forming a pocket where the water would stay, it would not get out until you tap it, although you might come within an inch of it and there might be standing thousands of gallons.

Q. Isn't it likely that as you get deeper there may be fewer of these intrusions hanging from the wall, and consequently fewer reservoirs and less water?

A. The existence of the pockets has nothing to do with the quantity of water that exists. If these pockets did not exist, the water would be universally distributed through the vein, in my way of thinking, so that, at the place where these pockets would cease, the water would be universally throughout the vein, and would be a great deal more trouble and bother to contend with than if it stayed in pockets, because, when it is in pockets, you tap it and it is done with, while where you have got it universally distributed it makes ore extraction a good deal more difficult.

Q. Won't there be fewer pockets as you penetrate to a greater depth? Won't the vein be more uniform?

A. The vein won't be more uniform. The vein matter will have a more uniform character.

Q. In other words, the hanging wall will be more fixed, and more likely to be in place?

A. That won't necessarily follow.

Q. Will it not? What is your opinion?

A. I think that at greater depth there will be less of these intrusions in the vein matter.

Q. Those intrusions come from the east wall?

A. That is my opinion.

Q. Then, if the vein is more regular after you get down to a low depth, and the intrusions less, won't the east or hanging wall be more regular?

A. That don't necessarily follow. The east wall is a very indefinite boundary, as far as we have explored the Comstock—as far as I know, at least.

Q. Do you know of any east wall anywhere?

A. Oh, yes.

Q. Where?

A. I know what we term the east wall is where we leave all quartz and go into feldspathic porphyry.

Q. What does that wall consist of?

A. Generally of a very heavy body of clay.

Q. Do you call the clay the wall, or the rock beyond it?

A. The rock beyond it; the boundary is the clay. The east wall is in very few places very well defined, but we have to take it as the east wall, and have to call it the east wall. We have got to get some terminus on the east. These eastern explorations that have been made further and further, striking more ore and clay, made the boundary line indefinite.

Q. With these reservoirs or pockets in different portions of the Comstock, would the running of the tunnel drain the Comstock at all—the simple running of the tunnel—considering these pockets and the formation of the Comstock?

A. Yes, sir; if these intrusions occurred less, and the pockets occurred less, and the water was universally distributed through the vein matter, you only need to tap the vein in one place, and all the water would drain off.

Q. I am not talking about that. Anybody knows that. I want to know, in the present condition of the Comstock, whether the running of the tunnel through the lode would drain any considerable portion of it?

A. It would drain all those portions that are connected with it. That I know. It would drain all those portions that are connected with the tunnel and the rock through which they pass.

Q. Would it assist in draining that portion of the Comstock that will be worked to a depth below the tunnel level? In other words, can you make water run up hill?

A. You can make it run up hill if you use the right implements to do it?

Q. You can pump it up?

A. No; it will run up itself.

Q. How else can you get it up except by pumping?

A. I can make water run up hill very easily.

Q. How?

A. By putting up a syphon, and carrying it over a hill where the height of the hill is greater than the surface of the water, and that would give it impetus enough to set the syphon going.

Q. Now, Mr. Luckhardt, we are talking about practicable things. I will ask you whether you have any idea now of applying that to raising this water from the Comstock below the level of the tunnel?

A. No. You asked me if I could make water run up hill, and I told you I would answer the question.

Q. That ain't making it run up hill. It is taking it to a point below the source. You spoke last night about the tunnel being a new basis of operations. Cannot you put in stations now in every mine, at a depth of 1,500 or 2,000 feet, and put in compressed-air engines to work the mines, making that a new base of operations, and then go on again 1,500 or 2,000 feet below that?

A. I suppose you could. You can, unquestionably; but, at the same time, you couldn't do it, in my estimation, at the cost of working through the tunnel, from the fact that you have everything to hoist from the tunnel level to the surface, which you avoid by using the tunnel. The hoisting from below the tunnel would cost the same, whether you take compressed air from the surface down to the machinery vertically or horizontally. The difference is some, but it is not great.

Q. Then, as I understand you, the difference would be

in hoisting from the tunnel level to the surface? Am I right?

A. Yes.

Q. You spoke last night of the average temperature of the Comstock, below the 1,000-foot level, as from 90° to 100°. How many mines were below the 1,000-foot level when you were there?

A. I stated that in the beginning of the report. I do not remember the figures exactly. I stated that I thought that the Bullion and the Crown Point and possibly the Norcross were down to 1,000 feet, may be a few feet more.

Q. Were you ever in the Bullion?

A. Yes, sir.

Q. How many times?

A. A couple of dozen times.

Q. How long before you left Virginia City were you in the Norcross?

A. I couldn't say exactly. I did not keep a record of it.

Q. Were blowers used in these mines?

A. Yes, sir.

Q. Was this temperature that you speak of, which averaged from 90° to 100°, in the headings and in the stopes where men were at work?

A. I was asked what the average temperature was. The headings and stopes—the upper portions of the stopes—were always hotter than where the drifts were connected with the shafts, from the fact of the hot air rising.

Q. Do you think the average temperature where the men were at work while you were there was from 90° to 100°?

A. I said from 80° to 100°.

Q. I understood you to say that, if the temperature were reduced to 70°, the capacity of the men to work would be doubled. Was that your opinion?

A. I think so.

Q. Do you think it possible to reduce the temperature to 70° there?

A. Yes, sir.

Q. That includes the sinking of a shaft, as I understand you, along the line of the Comstock, every 1,000 feet, to that tunnel?

A. Yes, sir, and connect them with one another, and make proper use of all the air which they command, and make the most judicious use of machinery.

Q. In addition to the sinking of the shafts and connecting them by drifts, you would have to apply artificial means for injecting fresh air into the stopes and drifts. I so understood you, did I not?

A. If you go beyond a certain point—beyond the limit of the air you demand—then you will have to find air from the surface. That is the only way in which I can answer that question.

Q. Would the sinking of the shafts and their connection, and the running of the tunnel reduce the temperature to 70°?

A. That question is not definite enough, Mr. Sunderland, because you may have 150 miles of drifts. That question is not definite enough; I cannot answer it.

Q. Would your drifts and stopes in the Comstock be any cooler than they are on the surface?

A. If there is moisture in the mine—

Q. I would like to have the question answered.

A. I will answer it in this way: If the timbers for some distance were wet, or if the rock was wet and the warm air would cause the water to evaporate and form steam or vapor, it would reduce the temperature in the mine from that which is on the surface. If that is not the case, practical experience has shown that the temperature increases from $2\frac{1}{2}^{\circ}$ to 3° Fahrenheit for every 100 feet in depth as you go down; also the heat is increased by the men working, the carbonic acid they exhale, and the miasma they leave behind, and the corrosion of vegetable matter in the mine.

Q. Well, now, what is the heat on the surface in the summer season in the Comstock?

A. Sometimes it is very warm, and sometimes it is only moderate.

Q. How hot?

A. I really couldn't say. I kept a record of it for a friend of mine here in Washington at one time—kept my barometer and the thermometer. I kept it up for three months, but I really forget what the average was.

Q. It isn't rare there to have the thermometer from 90° to 100°, is it?

A. Oh, no; I never saw it over 100°, I think.

Q. I say from 90° to 100°. Is that unusual at all?

A. Well, it is very warm. Of course it is hotter than it is generally, when it goes above 92° or 93°, as far as I recollect.

Q. I understood you to say last night that you never took your thermometer, to ascertain the heat in any mine but once?

A. Yes, sir.

Q. Now, sir, you can give the average heat in the mines by taking one observation; and yet, having kept records for a long time—having taken your observations on the surface—you cannot remember what that average is?

A. I know by the way I felt in the mines. I know how I experienced the heat, and it was oppressive. I was wise enough to know when I got under ground, and I have found the same temperature I have got on the surface. I wouldn't feel any warmer.

Q. Isn't the heat, at the same degree, much more oppressive in a mine, where there is no circulation of air or ventilation, than it is on the surface?

A. If you have a still hot day, and the air not stirring, it is just as oppressive on the surface as it is under ground.

Q. Is there ever a day on the surface on the Comstock that there is not some movement in the air?

A. No; I don't think there is.

Q. I will get you state whether on the Carson river it is not hotter in the summer time than it is in the Comstock on the surface?

A. That I could not say. When I was at the Carson river, I was generally on horseback, and I became hot from riding. I didn't notice.

Q. If the heat increases $2\frac{1}{2}^{\circ}$ to 3° every 100 feet in depth, and your thermometer stands at 90° on the surface, how are you going to reduce the temperature at the level of the tunnel to 70° ?

A. Exactly as I told you. If your air passes moist substances and has any motion to it at all, it will evaporate the water and cool the air. Then, where air is moving, the temperature is continually changing.

Q. What is the cause of the change?

A. Where air is moving fast, you cannot get a thermometer to stand at the same point for more than two or three seconds at a time. It is moving continually. It is the change in the temperature. I know of no other way to account for it, except that it is impossible, even in a heated room, to have a uniform temperature.

Q. I will ask you if the same degree of heat in a moist atmosphere is not much more oppressive than in a dry atmosphere?

A. Yes.

Q. Then if the atmosphere in the mines should be reduced, by evaporation of the water there, or by moisture, to 25° or 30° below what it is on the surface, would the heat be less oppressive, or more than it is on the surface? You spoke of reducing the atmosphere in these mines to 70° , while on the surface it was shown that the thermometer frequently rises above 90° , and in addition to the 90° , there is the increase of $2\frac{1}{2}^{\circ}$ every 100 feet as you go down. You go down say from 1,600 to 1,800 feet; adding the increase of that to the 90° , and you make it over 100° on the surface, and you propose to reduce it to 70° in the mines, and you reduce it by the pressure and resistance in the atmosphere in the mines. I want to ask you if the existence of the moisture there will not make the heat quite as oppressive as it is on the surface at 90° ?

A. If the air you get into the mine goes in at a temper-

ature of 100° , I don't suppose that there is a possibility of reducing it in the mines to 70° , I may say. There is a limit to all things, and so there is a limit to the reduction of the temperature by latent heat.

Mr. SUTRO. How many days in a year does the thermometer go up to 90° in Virginia city?

A. I have kept a record for three months at one time, but I do not recollect; 90° is very warm.

Q. Are there five days in a summer that the temperature rises to 90° , as far as you recollect?

A. I do not recollect. I might as well say 95° or 85° .

Mr. SUNDERLAND. Now, when you get your tunnel started, and the connections made with the shaft, how are you going to get the air to circulate down in the mines that are below the level of the tunnel?

A. That is a very easy matter.

Q. How do you do it?

A. Warm air has less specific gravity than cold air. Light air will rise, and cold air will sink. If you take air at a temperature say of 80° on the surface, and you have it at the bottom of a shaft 90° , which may possibly be the case, you can form a vacuum where the 90° are, very easily, and make the 80° follow it. If you get that current once, going at the rate say of only 10 feet a second, you may then, for quite a while, change the temperature, have 80° in the mine and 90° on the surface, and the 90° will follow as long as the impetus which the air has got lasts. You cannot do it but to a certain extent. When the impetus which the air has, once ceases, then it will operate to the contrary. When you construct ventilators, you must always be careful, if you have an impetus and a change should take place, to keep that impetus up by artificial means.

Q. If that can be done below the tunnel level, why cannot it be done through the shafts now just as well?

A. Because I believe that the tunnel, if you make a proper use of the air that comes through it, will greatly facilitate matters, and two or three degrees are a great deal in temperature and in ventilation. Let me give you an ex-

ample. I happened to figure the other day, by a formula given, as to the velocity of air, and I figured on 9° at 2,000 feet, and I found that a difference of 9° will give the air a velocity of 258 feet per second, or a pressure of $33\frac{1}{2}$ pounds to the square foot. That is equal to over two atmospheric pressures.

Q. Now, what application has that to anything here?

A. It has this: that, if the temperature down in the shaft should by some chance fall so as to stop this current which creates ventilation, the tunnel will give you sufficient air to keep the circulation going.

Q. Then you go upon the presumption, that the air in the tunnel will be colder than that in the surface at the top of the shaft? Is that your idea?

A. The air in the tunnel for a distance of I cannot say how many feet will certainly be colder than it is on the surface.

Q. Why so?

A. From the fact, as I told you, because the tunnel always accumulates moisture in some way. If it comes from the ground, the air passing through reduces the temperature.

Mr. PAYNE. The witness has stated that the increase of temperature, as you descend from the surface, is from 2° to 3° to every 100 feet?

A. Yes, sir; Fahrenheit.

Q. So that the increase per 1,000 feet would be from 20° to 30° ?

A. Yes.

Q. Now, what I want to know is, to what temperature this increase is to be added, to the temperature at the surface for the time being, or to some given temperature for the whole year round?

A. Added to the temperature as it is on the surface?

Q. For the time being?

A. No; because you cannot change the temperature in the mine. If the temperature were say 90° in the morning, and we would get a northwest wind which would

cool the temperature 15° , as sometimes happens on the surface, it wouldn't change the temperature in the mine near as suddenly, not probably in a month. In other words, the temperature in the mine in winter is pretty nearly the same as it is in summer, where there is no ventilation—no strong ventilation.

Q. Then, do you mean to say that, if the temperature at the surface would be 100° , the temperature 1,000 feet below it would be 120° or 130° ?

A. No, I won't say so. If I filled the mine with air, at a temperature at 100° , from the surface, it would in time rise to 120° in there.

Q. Then the temperature would be higher at a depth of 1,000 feet, if the temperature at the surface were 100° , than it would if the temperature at the surface were only 70° ? Does the temperature above at the surface, in other words, make any material difference in the temperature at a depth of 1,000 feet?

A. No, unless you carry it down there.

Mr. SUTRO. I want to ask you one question: Is there any change in the temperature, summer or winter, after you get down 60 feet into the earth?

A. That is what I have just said. I don't think there is.

Q. Isn't it generally assumed that at a depth of 60 feet there is not any change in temperature, without any draught going through?

A. No, sir; there will be no change down there.

Adjourned to March 28th, at the same place.

HEARING THURSDAY, MARCH 28TH.

Cross-examination of C. A. Luckhardt continued.

Mr. SUNDERLAND. I think you stated, Mr. Luckhardt, on your direct examination, that it would be 4 miles from the mouth of the tunnel to the mine?

A. That is the way I stated it from what I read and what I heard.

Q. What would be the distance from the mouth of the tunnel to the south end of the Comstock?

WITNESS. Which way do you mean?

Q. Going through the main tunnel of the Comstock, and then going off to the branch tunnel to the south end of the Comstock?

A. The way I understand it, the Sutro tunnel is to strike the Savage mine. From the Savage to the Justis is in the neighborhood of 2 miles, and the length of the tunnel would be nearly 6 miles, to the south end of the Comstock. If you take the Justis as the south end of the Comstock—or the North American as the south end of the Comstock—there would be some difference in the length. The distance to the North American, as far as the Comstock has been developed, would not be quite so much.

A. You stated, on your direct examination, that the men at work in the mines could be sent up in empty cars. Will you explain that again? Did you make that statement?

A. I do not recollect. I think that men could be sent up in the empty cars when the loaded car was coming down.

Q. Would you recommend that for the working of the Comstock?

A. That would depend upon the manner in which, and velocity with which, ore was sent down. If the men had to wait, it would cause loss of time, and in that case I would not recommend it; and if the ore was sent down from the upper portions of the mine to the tunnel level, and suffi-

cient ore was sent down at the time when the men go to work, why I should certainly say that that could be done. I would recommend it in that way, but otherwise not, because it would cause loss of time.

Q. You say you are intimately acquainted with the Comstock, and the manner of mining there. Considering the condition of the Comstock, and the mode of mining, would you recommend in any case that men should be sent up in a cage, where there was weight in another cage going down.

A. I would recommend it, if safety-cages were used.

Q. Don't you know that every mine on the Comstock uses safety-cages?

A. Not every mine.

Q. What mine does not use a safety-cage?

A. I have gone down in the Crown Point at times when I had no safety-cage, when they were hoisting ore. They didn't use the safety-cage, because it was too heavy.

Q. How long ago was that?

A. That happened at times. It was the time when I was there.

Q. When?

A. A little over two years ago.

Q. Do you know whether they use safety-cages in all the compartments of that shaft now?

A. No, I do not.

Q. Do you know any mine in the Comstock that is not now using safety-cages in each compartment of the shaft?

A. I do not know what they are using now, because I have not been there lately.

Q. You stated, in your direct examination, that you only knew of two mills that paid reclamations, and that they did not belong to the Union Mill and Mining Company. Please state what two mills you refer to.

A. I meant to imply that I knew of two individuals who owned mills in Washoe, and knew of their having paid reclamations. I do not know how many more paid reclamations. I do not know whether the Union Mill and

Mining Company ever paid any reclamations or not. I was only stating what I absolutely knew to be the fact. I do not wish to convey the idea that the Union Mill and Mining Company never paid any reclamation; neither that any of the other mill companies paid no reclamation. Those that I knew who paid that reclamation, were the persons I referred to.

Q. You stated, on your direct examination, that there are from 30 to 35 per cent. of silver in the ores on the Comstock, so mixed with base metals as not to amalgamate.

A. No, sir; I did not state that. I did not state 35 per cent. of silver, because there is no ore on the Comstock that contains 35 per cent. of silver. I stated that of the assay value of the ore, 35 per cent. of that assay value was contained in such a way in the ore, that it would not amalgamate by crude amalgamation.

Q. What becomes of that?

A. It stays in the tailings, and passes through the settlers, and is sometimes saved for after-treatment, and sometimes it is allowed to run to waste.

Q. Where, on the Comstock, and from what mill or mills, is any part of the tailings allowed to run to waste?

A. I do not know what they are doing now, but I have seen tailings run to waste for years there to such an extent that the people have washed the gulches through which the tailings have run, in order to get the amalgam that ran off with the tailings.

Q. From what mills?

A. I saw tailings run away from nearly every mill through Gold Hill. Some were saving none, others were saving very little, while some again were saving nearly all. I do not recollect, exactly, what mills they were, but the water that was running down Silver City indicated that a great deal of it was running away.

Q. Don't you know that all was caught before it reached the Carson river?

A. No, sir; I do not.

Q. Do you know anything of a reservoir in the upper part of Dayton, at the mouth of the cañon?

A. Yes, sir; I have seen several reservoirs there, built for the purpose of catching the tailings.

Q. Didn't they catch all the tailings?

A. No, sir; not at the time I was there.

Q. Where did the tailings go to after they left the reservoir?

A. In the river.

Q. At what point?

A. That I do not know; I cannot describe the point.

Q. Well, if you knew where they went into the river, I should like to have you name the point where they entered the river?

A. I cannot state it exactly.

Q. Did you ever see any tailings go into the Carson river from that cañon?

A. That cañon extends so far down that a great many tailings stopped there before they got to the river.

Q. The question can be very easily answered, Mr. Luckhardt. Did you ever see any tailings from that cañon run into the Carson river?

A. All that I call tailings—yes. I have seen the water colored with such. I have seen such run over the flat and run into the river.

Q. Whereabouts?

A. I saw tailings run from Yarrington mill, and run into the river.

Q. Is Yarrington on that cañon that runs through Silver City?

A. I cannot say that I saw the tailings run in there, but I have seen tailings lay close to the shores of the river and all through the cañons; so they must, at some period, have run in there.

Q. Was there not a succession of reservoirs along that cañon to catch the tailings?

A. As I stated before, I saw some reservoirs there, but the water gets so muddy that they cannot catch them all,

and some will run away, because the reservoirs were not large enough to allow the water to part with all its tailings there: it would carry off the tailings.

Q. How large is that reservoir at the mouth of the cañon at Dayton?

A. I could not give any dimensions; I never measured it, neither did I pay any particular attention to it.

Q. How high were the embankments making or forming the reservoir?

A. I could not state that. I did not measure that.

Q. Don't you know that Mr. Birdsall has been working for years on the tailings in that reservoir?

A. I understood so. I have been told so.

Mr. SUTRO. And could not get it out? He stopped last summer for six months.

Mr. SUNDERLAND. He got out enough to make him very rich. I know that much.

Mr. SUTRO. That shows there was something left in the tailings.

Q. I understood you to say that 60 per cent. was got out by the first working, and 36 to 37 per cent. of the remaining portion was rebellious. Was that your answer?

A. No; I stated that I thought that 60 per cent. could be fully depended upon, and in some cases even 65 per cent.; and that ore had been amalgamated to as high as 80 per cent. of the assay value; but I stated that the average should be taken between 60 and 65 of that, and that remaining within a few per cent. was rebellious, and that some of a small percentage was amalgam, which had been carried off with the slimes.

Q. What facilities did you ever have to know what any mill yielded?

A. I was well acquainted with Mr. Janin, and we spoke frequently about the treatment of the ores. He had very many new ideas, and we exchanged our ideas, and I got his results in that wise.

Q. Did you ever have charge of the mill, or work in the mill, and know what yield the mill gave?

A. I never had charge of any mill.

Q. Did you ever work in any mill, so as to know what yield the mill made?

A. Yes, sir.

Q. What mill?

A. I worked in the Central mill.

Q. Who was the superintendent of that mill?

A. A young man by the name of—I cannot recollect his name. He was superintendent for Atwood.

Q. Did Atwood ever run the Central mill?

A. Not that I know of. I do not know whether he owned it or whether he simply leased it.

Q. What ore did he work?

A. Ore from the Comstock. From what mine I cannot recollect.

Q. What position did you occupy in the mill?

A. Roaster.

Q. What process was used in that mill?

A. The common mill process, and the process of roasting, both. Both processes they used there.

Q. What year was that?

A. I do not recollect. It was the time when I returned from Austin. I cannot recollect the year exactly.

Q. How long were you in the mill?

A. I worked there as roaster for, I think, eight or ten days and then I was employed by the bank.

Q. Did you clean up while you were there?

A. I did not clean up.

Q. Was there any cleaning up while you were there.

A. Oh yes, sir.

Q. Is a roaster in a mill entitled to know the yield of the ore?

A. Not as a general thing, but I was; because circumstances compelled me to work as a roaster. I was not there exactly as a laborer, although I performed the duties of a laborer. I changed the method of roasting somewhat, and made some suggestions in the mill to the foreman.

Q. What per centage did you get out of the ore there?

A. I do not think I can answer that, because I do not remember. We were talking about it; I knew that the ore would mill 60 and 65 crude amalgamation, and when it was roasted it would mill 80 or 82, along there. I was told this, and truthfully told, because my opinion was asked by the superintendent about the method of working and how to improve it, if improvements could be made.

Q. Mr. Atwood is a scientific man is he not?

A. I have seen him work in his laboratory, in Washoe valley. I do not know whether he is a scientific man or not.

Q. Was the young man that you speak of a scientific man?

A. He was not.

Q. Did you crush dry?

A. We crushed dry at times, and crushed wet at times.

Q. And yet you cannot say what percentage of the assay value of the ore you got out?

A. I could not state any exact figure. I have given it as near as I recollect it.

Q. Don't you know that the mill was a failure, and had to be shut down long before you left Virginia?

A. I know that it was shut down long before I left Virginia, but I did not know of its having been a failure through not working the ores properly. I do not know why the mill was shut down.

Q. It was a failure, though?

A. That I do not know. I do not know why it was shut down.

Q. How long since that mill was shut down?

A. I cannot recollect.

Q. How was it that they did not save more than 60 per cent. in that mill?

A. In the first place, I did not say that they did not save more than 60. I say it ran, as far as I recollect, from 60 to 65, with crude amalgamation.

Q. Why was not there a larger per cent. saved?

A. Because the silver was in such a state in the ore that it could not be amalgamated.

Q. What percentage did you save by dry crushing and roast?

A. From 80 to 85.

Q. Then, if that is the only experience you have had in milling, and the only opportunity you have had of knowing what percentage is saved from the assay value of the Comstock ores, how can you state that they only saved from 60 to 65 per cent?

A. Because I have so frequently assayed those ores, and I know their character so well; I know what will amalgamate, and what will not amalgamate, that is just as good proof to me as if I had stayed in the mill and worked there for twenty years.

Q. But you do not know the actual returns from any mills that worked the Comstock ores?

A. I never inquired for any from any mill man, especially to show me his return.

Q. You have no means of knowing the actual returns?

A. Well, I have frequently talked with mill-men about it, and I always claimed that they held their percentage too high.

Q. In other words, that the mill-men did not tell the truth.

A. They might have told the truth. I do not wish to convey that idea at all, but they might not have known any better.

Q. The mill-men, then, are too ignorant to know what returns they make to the mines.

A. I do not mean to say that either. The idea I wish to convey is this: that it sometimes, and very often, has been the case that ores have been assayed when they come from the mine and turned into the mill, and the allowance for moisture was made by the mine to the mill; that the moisture was only jumped at; and very often that, when the ore was rich, would make a material difference in the assay value of the ore.

Q. State any case that you know of where any allowance was ever made for moisture.

Q. When I was in the Ophir, we always used to make an allowance for moisture, and I took it for granted that the balance also made allowance for moisture.

Q. What allowance did you make in the Ophir mine for moisture?

A. I made an allowance of from $2\frac{1}{2}$ to 3 and $3\frac{1}{2}$ per cent.

Q. Was not all the ore from the Ophir, while you were in that company, reduced at the company's mills?

Q. If you take it in one sense of the word, the mill in the Ophir cañon, I believe, was the property of the Ophir company, but had been leased to other parties, and these other parties worked the ore at a given rate; and there allowance had always to be made for moisture, because it stands to reason that if you take ore that is wet, and send it to the mill, and give the mill 10 tons, and have in that 105.40 pounds of water, and the ore was then sent to the assayer to be assayed, and he pulverizes it and weighs it, the ore becomes dry during that manipulation, even if he does not dry it previous to weighing it, to make his assay; then, of course, the assayer will give a higher assay, not with an intent to defraud anybody, but will give a higher assay than the ore was when it came originally out of the mine, and was weighed, and went to the mill.

Q. Is not the sample or assay from the mine always dried before it is pulverized?

A. As a general thing, as long as I have assayed, I have always dried it.

Q. Don't you know that the mills guaranty to the miners 65 per cent. of the assay value?

A. I have heard so.

Q. Now, how is it, if there is so large a percentage of the ores from the Comstock rebellious, and that will not amalgamate, that you can get 90 per cent. of the assay value from the ores at the mouth of the tunnel?

A. That I will explain. I stated, I believe, that it was

my opinion that ore could be worked up to nearly 90 per cent. at the mouth of the tunnel, or near the mouth of the tunnel, or at a place where facilities for working were. In this wise that—by the improved method of concentration which I know to exist and of which we have got data by employing this method of concentration—the rebellious portion of the ore could be concentrated, and afterwards properly treated by roasting, chloridizing, amalgamating, smelting, or whatever process should be necessary, and it could be worked to very nearly 90 per cent. in that way.

Q. Now I understand your proposition to be to first work the ores as they are now worked?

A. That depends upon the character.

Q. State your exceptions, and state your process?

A. I have stated the process. I do not say that in all cases I would suggest the amalgamation, as it is done now, as the first operation to be undertaken.

Mr. SUNDERLAND. That was my understanding.

WITNESS. That does not hold good in every case.

Q. State the exceptions, then?

A. The exceptions are, if the ore is in such a state where the percentage of refractory metal is not so great as 30 or 35 per cent., then I would certainly suggest their being amalgamated first. But if the percentage should be increased, as we have ores on the Comstock that even contain more than 35 per cent. the of refractory metals, why, then, I certainly should not suggest a preliminary amalgamation anterior to concentration.

Q. Then, in any case, you would suggest concentration, either before amalgamation or after amalgamation?

A. Yes, sir.

Q. And then roasting?

A. Either before or after amalgamation.

Q. The concentration—the roasting of the concentration—either before or after amalgamation?

A. Yes, sir, in case you wish to apply the method of amalgamation for the beneficiation of the precious metals. There are three different methods.

Q. Go on and make your own suggestions. I am simply getting at your ideas.

A. I am answering the questions as fast as you are putting them.

Q. Would you in all cases roast the concentrations?

A. No, sir; not in all cases.

Q. What are the exceptions?

A. I have just stated the exceptions are, that ores, for instance, such as those that exist in the north portion of the Ophir, would work more readily by being smelted than by being amalgamated: ores of that character I would not roast and amalgamate, but I would smelt them, provided the percentage of the silver would admit. The concentration from near the outcrop, from these low-grade ores, where the percentage of silver was a very low one, and the percentage of gold predominated, those ores I would not roast. Those I ores would roast by chlorination, and extract the gold from them in that manner. The others I would roast after the concentration, and then amalgamate them.

Q. What qualities have those ores that you speak of smelting, necessary to smelt them?

A. Those ores that contain Galena zinc, antimony, for instance. I would smelt those, providing the percentage of silver would justify the smelting operation. I wish to convey this idea; I am not saying that those ores that are at present in the North Ophir will admit of such a process, but that ores that will are liable to occur in it.

Q. Now, what would it be necessary, if anything, to add to the ores to smelt them; what will make flux?

A. All ores are not smelted alike. If the ore concentrated contains 20 per cent. of lead, for instance, they will smelt without additional flux. The addition of flux is one thing, and the mixing or charging of ores is another. When you smelt you never can work by one given rule. You must always smelt according to the character of the ore: for instance, the addition of iron, in some cases, is necessary.

Q. If you have a great deal of antimony your process in smelting would be nearly the same?

A. The process would, but the manipulations in the furnace would be a little different. You would concentrate those ores on those concentrators to such an extent that they would not require much flux, much addition other materials.

Q. Taking the base metals in the ores in the Comstock, where these base metals exist that you speak of, that will not amalgamate, would you have to add anything to them after concentration to smelt? If so, what percentage would you have to add?

A. I cannot give you the exact percentage, because, as I told you, it all depends on the character of the ore; sometimes you would have a higher percentage of antimony, and sometimes you would have a higher percentage of lead. You cannot work by a given rule in smelting; if you smelt Galena ores of 20 per cent. lead, and 40 per cent. gangue, and 20 per cent oxide of iron ore, and 20 per cent. of lime, you do not need any flux at all.

Mr. SUTRO. I would like to know what this smelting operation has to do with the tunnel.

Q. Is there any ore in the Comstock that you would concentrate, so as to have 20 per cent. lead?

A. There is ore in the North Ophir which could be concentrated to 20 per cent. of lead.

Q. Would it have any lime in it?

A. No, sir.

Q. Would you then have to add lime?

A. No, sir; I gave you an example only of where the smelting is very easy; it is not necessary to add lime.

Q. What would be necessary in concentrated ore—what would it be necessary to add to the concentrated ores from Ophir to smelt them?

A. Some of the concentrations obtained from the southern portion of the Comstock are very rich in sulphurets of iron.

Q. What mines have any considerable sulphurets of iron?

A. All of them; all of them have a certain percentage, and in concentrating them of course they all come into the concentration; if you take 50 tons of ore and concentrate them down to 1 ton, and you only have 1 per cent. of sulphurets, it would make the percentage of sulphurets very high in that 1 ton of concentration.

Q. You have spoken of chloridizing?

A. Yes, sir.

Q. What is that process?

A. I suppose you refer to chlorination. That process is used for all those ores where the percentage of silver is a low one, and it consists in this: that the ore is finally pulverized, moistened, first placed in vats and chlorine gas injected so that the gold is formed into a chloride, which is afterwards leached out with warm water, and the gold precipitated by sulphate of iron.

Q. Is that intended to save the gold alone or the silver as well?

A. That saves the gold.

Q. State if, as that furnace is operated at present, there is not great loss of gold?

A. You have reference to the Stetefeldt furnace?

Mr. SUNDERLAND. Yes, sir.

WITNESS. I do not know how to take that question. Please to repeat it.

Q. In roasting the ores containing gold and silver in the Stetefeldt furnace is there not great loss of gold?

A. That depends upon the percentage of the gold in the ore. In ore that contains a small percentage there is great loss; in ore that contains a high percentage there is hardly any.

Q. Suppose it contains one-third gold in value to the silver—one third of the whole, I mean—what would be the loss then?

WITNESS. In the Stetefeldt furnace?

Mr. SUNDERLAND. Yes, sir.

A. It is amalgamated to 91 per cent., in the trials which have been made at Reno.

Q. I understood you to say that ores assaying \$10 could be worked with profit from the Comstock by the Sutro tunnel; first give the items of cost of mining, precipitation, transportation, and beneficiating in any one you choose to give it in regard to?

A. I stated that it was my opinion that, when the tunnel was constructed and the different mines were connected with the tunnel, and the proper machinery was constructed at the tunnel, or near the tunnel, that \$10 ore could be worked with a profit of 90 cents per ton.

Mr. SUTRO. Did you not state, Mr. Luckhardt, that if it was sold to the company owning the mill there, they could buy that ore and pay 60 per cent. for it at the mine?

A. Yes, sir; and the figures are before me.

Q. Before going into those figures, I want to ask you one or two questions, and then I will have you refer to the figures. What does it cost on the Comstock to mine the ore, and in that cost include the expenses attending the organization of a company, and the dead work of prospecting connected always with mining?

A. I have seen a great many estimates made.

Q. I want you to make your own estimate.

A. I cannot make any estimate of what it costs now, because I have not been over it for two years.

Q. If you cannot make any estimate of the cost of mining ores, how can you make an estimate on ores assaying \$10 per ton, so as to make a profit?

A. Because those ores that assay \$10 per ton could be worked by the tunnel company, and I stated that they could be worked with a profit, if the tunnel company bought them from the mining companies, at the bottom of these shafts, at the rate of 60 per cent. of their assay value.

Q. Then you mean to say that there would be a profit to the tunnel company, and not to the mine?

A. The question was put to me by Mr. Sutro, and the

statement I made in relation to this was in the following manner: "Could not those ores be made to pay if 65 per cent. of their assay value was paid at the bottom of the shaft by the tunnel company?" and in relation to that I gave that answer to which you have reference.

Q. If ores are mined upon the Comstock, and delivered at the bottom of the shaft, the ores assaying \$10 per ton, can there be any profit to the mining company?

Q. That all depends upon how the mining company works. In some instances, I think, they could.

Q. What does it cost to mine ores on the Comstock?

A. The present cost I do not know. I have not been there for two years, and kept no account.

Q. Did you ever know what it cost to mine ores on the Comstock?

A. I think I did.

Q. What did it cost?

A. In some of the mines it cost \$2 50, and in others it cost as high as \$9.

Q. In what mine did you ever know ores to be mined at \$2 50 a ton.

A. I have mined at the Ophir, ore that did not cost me more than \$2 50 a ton. There was ore taken out of the croppings along the lode; and the other figure of \$9 I take as a maximum, because I have seen statements from different companies, varying from \$6 50 to \$7, \$7 50 to \$8 a ton for a year's estimate.

Q. Those ores you mined in the Ophir were on the surface?

A. Near the surface.

Q. They were raised to the surface?

A. Yes, sir.

Q. In the estimate that you make of \$2 50 per ton, you do not include the dead work that was being done in the mine for prospecting at the time, but simply the expense of taking out that ore?

A. Certainly not.

Mr. SUTRO. Let me ask the witness a question right

here: Have you seen ore mined about Gold Hill at \$1 a ton, where there was no difficulty about water, or any extraordinary mining difficulty?

A. I had to answer Mr. Sunderland's question. He asked me what I knew. I had my opinion about that. If he asked me what my opinion was, then I would have told him that ore had been mined at Gold Hill for much less than \$2 and \$2 50, because it was laying right on the surface, and it only required blasting.

Mr. SUTRO. Suppose there was no extraordinary mining difficulty, could not the ore be mined and let down to the tunnel at \$1 a ton?

A. That I could not say.

Q. If no machinery was required?

A. It could certainly be lowered down at a much less expense than it would cost to hoist it to the surface.

Mr. SUNDERLAND. Suppose the ore is on the surface, to commence with, can it be lowered any cheaper than taken from the surface?

A. It all depends on the distance.

Q. This ore you mined in the Ophir, could that be lowered any cheaper than raised to the surface?

A. No, sir; I believe not, because this ore that you have reference to in the Ophir, it being mined for \$2 50, if connections were made, could be lowered for the same price; but it would never pay, because that class of ore was of such a nature that the less you handled it the better it was, because it was very rich. If you had sent it down a long chute it would have crumbled and spread about in such a way that a great deal of the ore would have been lost. But I hold it costs less to lower ore than it does to hoist it, if you make proper connections—make your work easy by your connections.

Q. You do not mean to say that ore, generally, on the Comstock, that assays \$10, could be mined at a profit to the mining company and sold to the tunnel company at 60 per cent.—that is to say, \$6 a ton—considering all the expense attending the mine, including the expense of keep-

ing up the corporation, the expense of prospecting to find ore, and all dead work necessarily connected with the mines?

A. That all depends on circumstances. I could not tell you that without going into figures, and calculating all that it amounted to. I hold that there are places, and will unquestionably places be found, where ore cannot be mined for that, and carried to that tunnel level. I do not know of any place now.

Q. Don't you know that to find ore in the Comstock costs a great deal of money?

A. Well, of course it costs money to prospect.

Q. Then, is it not necessary, after going to all the expense to prospect to find a body of ore, that you shall get ore that will pay you more than the expense of mining and milling together even?

A. Certainly.

Q. You have got to pay for milling and mining; and, more than that, to get even on the prospecting?

A. I say it has to pay the expenses of extraction out of the ground, and the extraction of the precious metals.

Q. Now, I understood you to say that the steam power necessary for the reduction of ores at the mouth of the tunnel would be \$5 per ton.

A. That is the estimate I made.

Q. Is that the steam power alone, or is it the expense of reducing ore by steam? That is what I want. Is it simply the power, or the whole expense attending the reduction of ores by steam power?

A. Five dollars is the entire expense of milling and the cost of power to crush and to amalgamate; and of that \$5 \$1 99 is the cost per ton of the steam power.

Q. How much wood or coal do you consider necessary to reduce a ton of ore?

A. I hold that two tons of coal will work, crush, and reduce twenty tons of ore.

Q. Does that include the running machinery for concentrating?

A. No, sir.

Q. What additional expense would it be to concentrate?

A. I looked over the notes I got from Germany, and that have been taken for years in those concentrating works, and I made the allowance of the difference in labor and the difference in prices of everything as it is here, and I came at the figure of 50 cents a ton, but I made an allowance of 75 cents a ton for concentration.

Q. Then would that be \$5 75?

A. \$5 75.

Q. Using steam power?

A. Yes, sir.

Q. What do you estimate that coal to cost?

A. \$12 a ton.

Q. At what points?

A. At the point where the concentrating works are going to be put up. The way I understood it, they were going to be put up in the neighborhood of the tunnel. And I understood that coal could be furnished there at \$12 a ton.

Q. Who informed you that it could?

A. Mr. Sutro.

Q. You base most of your calculations upon what Mr. Sutro has told you?

A. No, sir.

Q. What would the water power cost to reduce ore there?

A. I calculated the water power at the same ratio that I calculated what it would cost to produce 40 horse power by water, at those figures. I calculated how much horse power it took to run these three consecutive machines, and from them I made my calculation.

Q. What was your calculation; what was the result?

A. The result was a little over 50 cents, but I allowed an additional 50 per cent. for contingencies, and I called it 75 cents.

Q. Seventy-five cents a ton?

A. Yes, sir. Of course all these machines are self-acting.

Q. I understand you to say that, by water power, ore

could be worked at or near the mouth of the tunnel for 75 cents a ton?

A. No, sir; I do not say that. I said that the ore, after it was crushed to a proper state, could be concentrated for 75 cents a ton.

Q. I want you to state now what ore could be worked for at the mouth of the tunnel by water power.

A. It was a dollar less than what it cost for steam power.

Q. That would be \$4 75.

A. Yes, sir; \$4 for working by the ordinary process; that is, crushing and amalgamating, and afterwards concentrating, at 75 cents a ton. I do not wish you to misunderstand me. I do not say that the ore can be taken and crushed and concentrated for 75 cents a ton, but after it is in a proper state, then it can be concentrated for 75 cents a ton.

Q. Then, after you have the tailings concentrated from ten tons to one, I believe your proposition is, what will it cost to work those concentrations?

A. I allowed that the beneficiations of the concentrations would be \$8 a ton at the maximum.

Q. You stated that, by running the ore from the tunnel, the ore from the Comstock would be triple in value?

A. I believe I stated that it was my opinion that, when the tunnel was in there, a great deal more ore would be produced: I do not know that I stated treble. I stated that it was my opinion that more ore would be gotten out if the tunnel was in and the shafts all connected.

Q. Did you state that the saving to the mines, by the running of the tunnel, would be over \$10,000,000?

A. I did not state any figures. I merely said I thought the saving would be considerable.

Q. I understood you to say, that one ton of the Rocky Mountain coal will be equal to 2 $\frac{1}{4}$ cords of wood?

A. Yes, sir.

Q. How long have you had an office in San Francisco?

A. A little over 15 months.

Q. How many tons of ore have you worked since you have had that office there?

A. Quite a number.

Q. About how many?

A. Over 100 tons. I have worked lots there of 100 pounds. That would involve the same amount of work as if I had worked 5 tons.

Q. Since you have established yourself in San Francisco, what has been the extent of your business or employment as a mining engineer?

A. I have been employed, off and on, at various times, to make reports.

Q. What mines have you examined and reported upon?

A. I have reported on quicksilver mines, silver mines, and gold mines, hydraulic works, gravel diggings, &c.

Q. What silver mines have you reported upon?

A. I have reported upon the silver mines situated in Owen's valley.

Q. What do you know of the proposed dam on the Carson river?

A. Nothing.

Q. At whose instance did you come here to testify in this case?

A. At the instance of a friend of mine in San Francisco.

Q. Who?

WITNESS. Have I got to state that? I reckon I might as well state: Mr. Sharon.

Q. How much do you get for coming here?

A. My expenses paid.

Q. Nothing else?

A. No, sir.

By Mr. SUTRO:

When they got into difficulties in their mining operations, did they not employ you in many instances in order to advise them; to bring their operations into shape again?

WITNESS. Who do you mean?

Mr. SUTRO. Some of the mining companies on the Com-

stock lode. Did they not send for you at the Ophir mine, the Justis mine? Have you gone there when they could not get along by themselves?

A. I got my position in the Ophir mine through the recommendation of Mr. Richthofen and Mr. Janin. They suggested I could stop their water, which was troubling them at the time.

Q. Do you know anything about the expense of raising water, independently of the actual cost in raising water. I mean the expense attending the working in water, and the difficulties of being troubled by water, while you were there? I want to know whether there is expense incurred in having much water in the mine, independently of hoisting the water out or pumping it out?

A. Where there is much water there is always a great retardation in the work.

Q. Is not that a greater expense than actual pumping?

A. Oh, to be sure. The pumping itself is the least of the expenses of getting rid of the water.

Adjourned to meet March 29th, at the same place.

HEARING FRIDAY, MARCH 29TH.

Charles A. Henry called and examined.

By Mr. SUTRO:

What connection have you with the coal mines of the Rocky Mountains?

A. I am the general manager of the Rocky Mountain Coal and Iron Company of Wyoming and Yarrington.

Q. Where are those mines located?

A. Located on the boundary line of Utah and Wyoming, 75 miles east of Ogden, Utah.

Q. Have you supplied the different stations of the Central Pacific Railroad with coal?

A. We have supplied them with all they have used.

Q. Have you ever delivered any coal at Reno?

A. Yes, sir; for the last year and a half.

Q. At what price have you delivered it?

A. Well, it has varied in price according to the variation in freights. It is being delivered now for \$12 and at \$12.50 a ton.

Q. Would you agree to contract and deliver a large quantity of coal per annum at that price at Reno?

A. A large quantity is indefinite.

Q. Would you agree to deliver 20,000 tons a year?

A. Yes, sir; we would contract to deliver 100,000 tons a year.

Q. Are you acquainted with the topography of the country between Wadsworth and the mouth of the Sutro tunnel?

A. No, sir; only a portion of it. I have not been over there.

Q. Are you aware there is a gap in the mountains, connecting the Truckee valley with the Carson valley at that point?

A. I have been told so by the engineers.

Q. Have you an idea of the approximate distance from Wadsworth to the mouth of the tunnel?

A. I have understood some 30 miles.

Q. So far as you know, is not it a level country?

A. My knowledge of the country across there is what I have gathered from engineers of the Central Pacific road?

Q. What is that?

A. I got the impression from these parties that there was no elevation of any importance between Carson City and Wadsworth.

Q. Could a branch of the Pacific railroad be constructed from that point to the mouth of the tunnel?

A. I suppose if they had enough money to do it, they could build it.

Q. How much does it cost a mile to build the road?

A. It is impossible for me to state accurately a thing of that kind.

Q. After you cross over from Truckee river to Carson valley, that is known to be level, is it not?

A. I do not know that of my own knowledge. I suppose it to be an average level country.

Q. You are familiar with railroads. Can you tell me the approximate cost per mile of constructing a road through that country, without including the rolling stock?

A. My judgment would be that \$20,000 a mile would be a liberal estimate for a country with fair grades.

Q. Or less?

A. Yes, sir; \$15,000 a mile will about cover all the expenses except grading and bridging; that is, without rolling-stock and stations. It is impossible to estimate the expense of rolling stock, from the fact I do not know how much rolling stock you would want.

Q. How much would that be for 30 miles?

A. \$600,000.

Q. Suppose that road be constructed, could that coal be delivered at the mouth of the tunnel at the same cost it could be delivered at Reno, or less?

A. That would depend entirely upon the tariff by the parties who built the branch road.

Q. Suppose the Central Pacific company were given a contract to deliver it there, would they not deliver it there at the same price they could deliver it at Reno, or at less price?

A. It would not cost any more for the Central Pacific, if they had a road to the Sutro tunnel, to deliver coal per ton from Ogden than it costs them now to Reno.

Q. Suppose the Sutro tunnel received the coal at Wadsworth?

A. It would make a difference of 50 cents a ton from receiving it at Reno. It is 30 miles.

Q. Now, I want to ask you how you would estimate the heating power of coal, as compared with the Sierra Nevada wood, for the purposes of making steam?

A. Well, with the fire-boxes constructed, and the grates set for burning coal in place of burning wood, the difference between the coal, which we mine, and the wood, which is delivered at Virginia City, is about in the proportion of 1 to $2\frac{1}{4}$, or, in other words, 1 ton of coal to $2\frac{1}{2}$ cords of pine wood.

Q. Suppose that a railroad be constructed—this branch road—could any reasonable quantity of coal which would be required be delivered there?

A. Our works at present will deliver, without erecting any additional machinery, 1,500 tons of coal in a ten-hour shift.

Q. How much do you get for your coal at the mine?

A. From \$2 25 to \$3 a ton; \$3 to private parties, and \$2 25 on contract.

Q. Do you know that all the mills in the Washoe country use steam, which are propelled by engines, as well as those which are propelled by water power?

A. I know that all about the Comstock lodes are operated by steam, but on the Carson river the mills are worked by water.

Q. Do not those water mills require steam for heating the amalgamating pans?

A. I have the impression they do, but I am not positive about it.

Cross-examination.

By Mr. SUNDERLAND :

You say that the Central Pacific would deliver coal at Wadsworth at 50 cents per ton less than at Reno?

A. That would be about the difference. The distance is 35 miles, and the rates about a cent and a quarter per ton per mile.

Q. What difference is there in their charges between Ogden and Reno and Ogden and Sacramento?

A. \$2 00.

Q. What do you deliver coal at Sacramento for?

A. \$13 25. Allow me to explain, in that connection, the reason. There is only a difference of \$1 a ton in price between coal at Sacramento and at Reno. Although there is a difference in the rate of the Central Pacific of \$2 more to Sacramento than to Reno, the Union Pacific charges about 75 cents per ton more for coal to be delivered at any point east of the Sierra Nevada from our mine to Ogden than they do for coal delivered to Sacramento west.

Q. Is not the great expense in transportation of coal from Yarrington west across the Sierra Nevada? I mean the expense to the railroad company.

A. Yes, sir, in about the proportion of 1 to 5 per mile between Wadsworth and Sacramento, as compared with the road between Humboldt and Wadsworth.

Q. Do not the stockholders in the Central Pacific Railroad Company own and control a majority of the stock in your mine?

WITNESS. The stockholders of the Central Pacific?

Mr. SUNDERLAND. Yes, sir.

WITNESS. No, the stockholders of the Central Pacific do not own a majority of the stock. They own stock in our company.

Q. Do not the parties who control the Pacific Railroad Company control the coal mine?

A. None of them are officers of the coal company—either directors or officers.

Q. That was not the question I asked. State the name of your coal company.

A. The Rocky Mountain Coal and Iron Company.

Q. Now I will get you to state—

A. All the business operations of the Rocky Mountain Coal Company, from its organization, have been made by me; as the managing contractor. I have not been controlled by any party connected with the Central Pacific, in directing the operations of the company. As the question of freights is the most important one we have had to encounter, we have had to come in direct collision with the views and notions of the owners of the Central Pacific, in helping to procure a reduction of rates for coal.

Q. I understand you to say that 1 ton of this coal, for steam purposes, is equal to $2\frac{1}{4}$ cords of wood, of the Sierra Nevada pine wood—of the ordinary pine wood?

A. It is not equal to $2\frac{1}{4}$ cords of nut pine.

Q. There is very little nut pine in use?

A. Yes, sir; but there is a great deal in use for steam.

Q. Have you had any experience in the use of that wood for steam purposes?

A. No, sir; I have never used it myself, but I have seen it used, and watched the operations of using the wood for steam on locomotives, and also for stationary engines. We claim that there is more difference, as far as cost is concerned, to the parties who use fuel, than the actual difference in the heating properties of coal, as compared with wood, from the fact that, in using wood, it is necessary for the wood to be seasoned a portion or all of one year. From the difficulties of storage, danger of fire to the wood, parties are obliged, who are operating extensively in machinery, to keep nearly two years' supply of wood on hand. We calculate that when the parties wish to use fuel for

steam purposes, 1 ton of coal is cheaper than $2\frac{1}{2}$ cords of wood, taking these other matters into consideration.

Q. How far west of Ogden does the Central Pacific use this coal?

A. To San Francisco, with the exception of the division from the Sierra Nevada Mountains through the pine region.

Q. You do not mean to say they use it at Reno; that is, the Sierra Nevada?

A. The division commences at Wadsworth. They use wood from Wadsworth to Sacramento. They use wood and coal together from Wadsworth to Winemuca, the first division east of Wadsworth.

Q. How far is Winemuca from Wadsworth?

A. 136 miles.

Q. Do they use any coal between Wadsworth and Winemuca?

A. Yes, sir; they use coal more or less all through the Sierra Nevada region, mixed with green wood. Wherever they have dried wood, they have used wood exclusively on their engines across the mountain range. They propose to furnish that coal for the entire length of their road, including the mountain division, for the coming year.

Q. Do you employ white men or Chinamen?

A. Both.

By Mr. SUTRO:

Is the supply of coal in the region where your coal mine is located quite unlimited?

A. Unlimited is a very indefinite term.

Q. Is it so large that you can supply all the wants for the next 50 years?

A. We have, by our main tunnels in our coal bed, developed by measurement a body of coal of over 30,000,000 tons. The division of coal extends over six miles beyond the end of our tunnels, which are 900 feet.

Q. That is one single bed?

A. Yes, sir; 26 by 42 feet.

Q. What do you estimate as the consumption of coal in the State of Nevada?

A. About 500 tons per day.

By Mr. SUTRO: Mr. Chairman, I have no more witnesses at present, but I desire to offer a statement in regard to the quantity of water in the Ophir mine, made by the different superintendents of that mine.

Mr. SUNDERLAND. I protest against this kind of evidence. The testimony taken by this committee has been under oath, and here it is proposed to submit a statement of the superintendent, who has not been and can't be sworn. What the statement is I do not know, and I do not care. But the ruling of this committee has been that no testimony, except that by a Government officer, is to be received, unless it is under oath. Now, these statements made by the superintendents to the commission have been appended to the report of the commission as evidence, but not received as such. In fact, the whole labor of Mr. Sutro, from the commencement of this examination, has been to show that these statements were incorrect. In other words, they were false; they were not made under oath, but, as a matter of courtesy on the part of the commission, they were appended to the report, as well as the stump speech of Mr. Sutro, which he made in the year 1869. Now, I do not suppose that this committee regards that speech of Mr. Sutro as having been made under oath, or as being any part of the report. And this committee having ruled that all testimony of Government officers must be under oath, I do not see how it is possible to receive this report from Mr. Deidesheimer.

Mr. RICE. I will explain this testimony. The committee will remember that these reports of the superintendents to the commissioners were made a part of their report. They called them the official reports. This is an official report from the superintendent of the Ophir mine, giving the daily operations of the mine, especially as to pumping water for a length of time.

Mr. SHOBER. Who was the report made to?

Mr. RICE. To the officers in San Francisco. This was the daily report of the superintendent to the home office at San Francisco. This report is certified to by the parties having charge of these matters at the office there.

We took the precaution after this came to send out and have another copy made, and that is certified under oath, before a notary public. So we bring ourselves within the rule laid down by Mr. Sunderland. I will read a letter I have here:

"OFFICE OPHIR SILVER MINING COMPANY,
"VIRGINIA CITY, March 13, 1872.

"ADOLPH SUTRO, *Washington, D. C.*

"DEAR SIR: In compliance with your request, by telegram of yesterday, I herewith forward press copy of extracts of letters of Ophir superintendents, concerning pumps, pumping, &c., forwarded you through Joseph Aron, esq., Feb. 22, '72. Also copy of statements forwarded you Feb. 16, showing mine cost, and direct cost of pumping for January, 1872, together with explanation of indirect cost of raising water; also certificate that the statements and extracts are correct and complete, as shown by the books of the company in this office.

"Very respectfully, your obedient servant,

"PHILIPP DEIDESHEIMER,
"Sup't, *pr Ford.*"

Mr. KENDALL. Will you read the affidavit?

Mr. RICE. I will read the affidavit attached to this.

Mr. RICE then read as follows:

"OFFICE OPHIR SILVER MINING COMPANY,
"VIRGINIA CITY, March 13, 1872.

"STATE OF NEVADA, *County of Storey, ss:*

"We hereby certify that the accompanying statement, and figures are materially correct, as shown by the books in this office, and also that the extracts inclosed embrace all that is mentioned in letters of superintendents of the Ophir S. M. Co., to the office of the company in San Francisco, concerning pumps and water, within the dates therein given.

"PHILIPP DEIDESHEIMER,
"Supt. *Ophir S. M. Co.*

"G. F. FORD,
"Clerk *Ophir S. M. Co.*

"Subscribed and sworn to this fourteenth day of March, A. D. 1872, before me.

[L. s.]

"WILL. H. BURRALL,
"Notary Public."

Mr. RICE. Now, Mr. Chairman, this is under oath. It has a very important bearing upon the very question which is at issue in this case. The committee and Congress desire to know the facts in regard to the water, which is material in deciding this question. And although we believed

that the first copy sent to us was amply sufficient, under the rule which had been adopted by the commissioners, to put into the case—the official report, as they say, of the superintendents of the mines—still, anticipating this objection, we have obtained the official statement of this gentleman, under oath, of the daily proceedings of that mine, and one of the superintendents is Mr. Day, who made the report to these commissioners. His letters appear here, to sustain our theory of the case, as we say. Sometimes it is for us; sometimes against us. We desire to put it into the case, so that the Government shall have the facts upon this material point as to the amount of water in that one mine. We would be very glad to put in such a statement from every other mine on the lode, because we desire full investigation of this matter what we want is just that, and nothing more. If we could have had a daily statement of the amount of water and the cost of raising water in every mine on that lode, it would be the most agreeable thing to us possible; and I do not imagine that this committee will exclude testimony so material to the issue.

Mr. SUTRO. Mr. Chairman, shall I proceed to read these letters?

The CHAIRMAN, (Mr. KENDALL.) I should like to look at this affidavit once more.

The affidavit was handed to the chairman, and after he had examined it, Mr. Sunderland said: The committee will understand that this is an examination of witnesses before the committee, where there has been no opportunity to cross-examine, and, under the decision of the committee, each witness must be sworn. The party opposed to the one offering the testimony is entitled to the privilege of cross-examining the witnesses. Now, it seems to me that a mere affidavit cannot entitle these letters to be received in evidence, and particularly for the reason that the man making the affidavit, if he make a false one, cannot be prosecuted for perjury. To entitle anything to be given in evidence, before any committee or any court, there

must be such an oath administered to the witness that, if he swear falsely, he can be prosecuted for perjury by it.

Mr. SHOBER. Did not this man swear to his affidavit before a notary?

Mr. SUNDERLAND. If a man swear to a fact before a notary public, unless it be authorized by special act of Congress, he is not guilty of perjury. Unless the administration of such oath was authorized by some act of Congress, he is not guilty of perjury.

Mr. SHOBER. I understood the general proposition to be, that if a man swear to a paper before a notary public who has authority to administer oaths, and should swear falsely, that he could be prosecuted.

Mr. SUNDERLAND. I say he has not committed perjury, if he has sworn falsely. A notary public is authorized to administer oaths by what authority?

Mr. SHOBER. By virtue of his office.

Mr. SUNDERLAND. He is authorized to administer oaths in any proceedings before a court, or in any matter authorized by law, by the statutes of the State of Nevada; but the State of Nevada may authorize any officer to administer an oath, which is not recognized by act of Congress; and, therefore, if he swear falsely, he is not guilty of perjury under any act of Congress, or under the act of the State of Nevada, which authorizes the appointment of notaries public. In addition to that, I urge again the objection that, under the rule established by this committee, the witness is to be before the committee, and the opposing party is to have the right of cross-examination. I have had no such opportunity here before this committee.

Mr. SUTRO. I wish to submit——

Mr. SUNDERLAND. I believe I have the closing argument.

Mr. SUTRO. I wish to submit that the affidavit which is presented here simply certifies to the fact that these are copies of letters, written in an official capacity by the superintendents of the Ophir mine to the president of the company at San Francisco. Those letters are copied in the office of the Ophir company. The superintendent is

the custodian of those letters; and he has made copies from his books, and he certifies to that fact. A large number of these letters are written by Mr. H. H. Day. They have a direct bearing upon the condition of the Ophir mine, as concerns the water, and they are of the highest importance in arriving at a correct conclusion as to the quantity of water contained in that mine. They go over a long period of time, and were written from day to day, and they are in the shape of reports to the office at San Francisco, giving full information as to the condition of the mine. These letters have a most important bearing upon one of the most important questions involved in this investigation, and there could possibly be no objection to admitting these letters, which are accompanied by an affidavit before a notary public; while the statements made to the commissioners were made without being sworn to at all. We ask that they may be introduced.

Mr. SUNDERLAND. If that is the ground upon which it is proposed to introduce these letters, or copies of letters, I propose to object to them, upon the ground that they are letters written by parties not under oath. We have not received a communication from anybody, except Government officers, that were not under oath. It is now stated that the affidavit, which I have not read and do not care to read, is to the effect that these are copies of letters—copies of letters by the superintendent of the Ophir mine to the office in San Francisco. Suppose you had the originals there, the only office which the affidavits of Mr. Deidesheimer can perform is to make the copies of the same effect as the originals. Would you receive the originals? Why certainly not, because they are not official in the sense of the word used by this committee, and as they have heretofore decided.

Mr. SHOBER. Suppose you take those letters as rebutting the statements made in the official report of Mr. Day. Suppose the originals were here, would they not be admissible, by proving them to be in his handwriting?

Mr. SUNDERLAND. They would, to rebut the testimony

given in his report, if they have that effect. But here is an affidavit from Mr. Deidesheimer. Now, who is he? He is the present superintendent, if I understand, of the Ophir Mine. Now, the Ophir Mining Company has possession of these original documents. Why not produce them? You cannot introduce evidence of the contents of the original paper until you have exhausted all the means possible to get at the originals.

Mr. SHOBER. Suppose it is a record?

Mr. SUNDERLAND. It is not a record.

Mr. SHOBER. Suppose in case of a record?

Mr. SUNDERLAND. How can a letter be a record.

Mr. SHOBER. I do not say it is; but, by way of analogy, is not a transcript of a record as good proof as the original, when it is properly certified?

Mr. SUNDERLAND. No, sir.

Mr. SHOBER. It has been so held?

Mr. SUNDERLAND. That is in the case of a record of the proceedings of a case in court.

Mr. SHOBER. I was speaking of a record in court.

Mr. SUNDERLAND. But suppose you have the record of a deed—suppose you have a certified copy of a record of a deed, certified to by the recorder who copies the records, you cannot introduce that until you account for the absence of the original. Now, here we have what purports to be copies of letters sent by the superintendent of the Ophir mine, in Virginia City, to the office at San Francisco. These are not the copies, but copies of copies. Now, no lawyer ever heard or dreamed anywhere of introducing copies of copies, in the absence of the copies themselves, unless the copies are destroyed. Nor did anybody hear, in a court of justice anywhere, of the introduction of a copy of any paper, either recorded or otherwise, until all the means had been exhausted that the law places in the hands of the party to get at the original. These originals are in possession of the corporation in San Francisco. They could have been sent here, if they impeach the statement and report made by Captain Day. If they are destroyed,

and that fact is shown, you might introduce press copies of the letters retained in the office in Virginia City, if that be the case, and send to the office in San Francisco. But those copies have not been sent here, if such were retained. But all that this document here purports to be is, that it consists of copies of letters sent by Captain Day and Mr. Deidesheimer to the office in San Francisco.

The CHAIRMAN, (Mr. KENDALL.) Mr. Sunderland, if I may be permitted to suggest, in the course of your argument, suppose that these letters are in the nature of admissions or declarations by the party, put upon paper, of which these papers are copies. How would it stand then?

Mr. SUNDERLAND. I do not care what they are; they are not declarations of the parties that any court of justice in the civilized world would admit as evidence to impeach the testimony originally given by Captain Day.

Mr. RICE. Mr. Chairman, I have simply a word to say in regard to this matter. In the first place, there are three parties represented here: one is the government—the most important party. That party you represent more than anybody else. On the other hand is Mr. Sutro, who, with his counsel, represent the tunnel company, who have a bill before Congress. On the other side are the supposed owners of these mines, who come here to contest with Mr. Sutro upon the material facts. There are brought into the record by the commissioners who were appointed by the President to examine this subject certain declarations of certain men who were superintendents of these mines, and clients of Mr. Sunderland here. The superintendent of one of those mines who made those declarations has since ceased to be an officer of that company, and the mine has passed into other interests and other hands. We have been at last enabled to get at the facts in regard to one of those mines, because we purposed to put in here those facts, which we desired to present; and we have been desirous of putting in every possible fact which could have any bearing on this case, either for or against the proposition—for Mr. Sutro or against Mr. Sutro; for these

mines or against these mines. We have courted the most thorough investigation, and now, when we come here with the most satisfactory facts upon a most material point in this investigation, we are met with an objection, a technical objection. Well, now, gentlemen, throwing aside all the arguments of my friend, Mr. Sunderland, I say that you are here not bound by technical rules. You are here for the purpose of getting at facts. You are here especially as the representatives of the Government, and you are here to inquire through every channel of evidence which you believe trustworthy, to get at those facts by which you may determine this question.

Now, we come here with the best evidence. We could not take the books from San Francisco and bring them here. This question was thrown open upon motion of Mr. Sunderland, the agent and attorney of these mines, and now we propose to put in here these facts from his own people, and he comes here and contests it, and says we shall not have this evidence before us.

Now, I submit, gentlemen, that it is the most satisfactory evidence that could be possibly put into this case, because it is the daily record of the proceedings of that mine, and the amount of water raised from that mine from this dry country, as stated by Mr. Day, when we show overwhelmingly that the water was working out the very life-blood of the mine day by day, and we are met here with this objection. I do not think you will give weight to any technical objection which will interfere with your getting at the facts. You are here for the purpose of getting at the facts, and you will pass all those technicalities by, in order to get at such evidence as will lay them before you.

Now, so far as the question of the liability of these parties to prosecution for perjury is concerned, I will say that this gentleman who makes the affidavit to these facts is the superintendent of the mine.

He is the custodian of the books, and he, under oath, swears that these are extracts from the records of the pro-

ceedings at the mine. He goes on to say that he is not liable to indictment if he swears to a falsehood. I take issue with him there decidedly. A notary public is an officer who takes certificates of facts, to be used in all courts throughout the land; and if this is a proceeding that is proper at all, and if there is any validity in taking anybody's oath, why, then, if this gentleman has sworn to a falsehood, he is liable to prosecution for perjury.

The simple question for you to determine here is, whether this is material to the issue before you, and whether it is such testimony as you desire for your own information, and the information of your colleagues in both branches of the Congress of the United States.

Mr. SUNDERLAND. I leave it to the committee.

The CHAIRMAN (Mr. KENDALL) said: The committee, upon consultation, are agreed upon this: that these copies of letters—of what are claimed to be original letters—are in the nature of admissions or declarations. Now, it is true, that if the strict technical rule were followed, the party might properly insist, as is urged here by Mr. Sunderland, upon the production of the original of these letters, which are certainly the best evidence; but, in reply to that objection, I think I might say that it is very obvious that the committee is not sitting here, strictly speaking, as a court, to be governed by the technical rules of evidence that prevail in a court of justice. We are here, it is true, to a certain extent, in a judicial capacity, but still we are entitled to gather evidence that is proper to be used from all sources. Now, here are certain admissions or declarations, claimed to be made by Mr. Day, and those declarations are verified by an affidavit, which sets forth that the papers produced here are accurate copies of original letters. Again, we have certain statements made by Mr. Day embodied in the report of the commissioners. If we were to follow the technical rule insisted upon by counsel, it might have been urged that these statements, embodied in the report of the commissioners by Mr. Day, were not under oath. The objection might have been

raised that the best evidence of these statements, made by Mr. Day in this commissioners' report, was the original paper which he produced, and which he handed to the commissioners. The printed report of Mr. Day's statement is not, it might have been claimed, under oath.

Would counsel require the written statement that was handed in to the commissioners by Mr. Day, and insist that it be verified by his oath, and so on. Of course that would have been carrying the rule to an extreme limit: a very absurd one, in my opinion. We have here offered in evidence a sort of supplementary statement, or what is claimed to be a supplementary statement, made by this same Mr. Day, to that set forth in the commissioners' report. It appears that this statement was copied from the original letters—from original sources—and are copies made under oath. It seems to me and to the members of the committee present, that it is within the general rule that has been adopted by the sub-committee in this hearing as regards the admission of testimony. I suppose, to illustrate still further what I mean, that, if we were sitting here as a court, and were to receive nothing but evidence under the strict rule, these commissioners themselves should have been put under oath; for in a court of justice, strictly speaking, they would not have been permitted to testify unless they were under oath. But we have required none of the Government officials to be sworn—as a matter of courtesy it may have been, but I think on still better grounds—because they were called here before the sub-committee to explain certain matters that were embodied in their report to Congress. The committee present are clearly of the opinion that the offer is within the general rule that has been adopted in this hearing by the sub-committee. Upon these grounds the evidence is admitted.

Mr. SUNDERLAND. Without further protesting against the admission of these copies, I wish simply to state that the reports of the superintendents upon the Comstock are not evidence before this committee, and have never been so

considered. They have been appended to the report of the commissioners, which was official, simply to show to this committee and to Congress the source of the information upon which the commissioners made their report.

Mr. RICE. Mr. Sunderland, do we not stand on the same footing, then?

Mr. SUNDERLAND. No, sir. I wish to state, and I do not wish this to be taken down as part of the evidence——

Mr. SUTRO. Oh, let every thing be taken down.

Mr. SUNDERLAND. Since Mr. Sutro has made the suggestion that every thing that transpires shall go down, I wish now to move to amend the record of the proceedings of this committee on the evening when General Foster was last examined, at which meeting I proposed to prove by General Foster that the capital stock of the Sutro Tunnel Company was \$12,000,000——

Mr. RICE. I submit that the amendment of Mr. Sunderland has no application to anything before the committee.

Mr. SUNDERLAND. And that on the 19th of August last——

Mr. SUTRO. I protest against Mr. Sunderland using up our time in this way.

Mr. SHOBER. Let him be heard.

Mr. SUNDERLAND. Which stock was full paid or unassessable; that less than \$5,000,000 out of \$12,000,000 had been retained by the company, and set aside for the construction of the tunnel; that at that time only \$31,000 was in the treasury.

Mr. SUTRO. That is not so.

Mr. SUNDERLAND. I would like to give——

Mr. SUTRO. I would like counsel confined to a statement of facts.

Mr. SUNDERLAND. I have at every meeting since the time alluded to attempted to get this thing on record for the purpose of appealing from the sub-committee to the general committee, and I have never yet been able to get it into the record.

Mr. RICE. I wish to say in regard to that, that we withdrew orally all objection to that testimony going in.

Mr. SUNDERLAND. That is, you agreed to do it after General Foster had left town and the evidence could not be had.

Mr. RICE. No, sir.

The CHAIRMAN. Gentlemen all the argument is closed. The extracts from letters offered in evidence are admitted, and they may now be read. The extracts were *then read as follows: (See next page.)*

EXTRACTS FROM LETTERS
FROM
SUPERINTENDENTS OF OPHIR MINE
TO THEIR
COMPANY'S OFFICE IN SAN FRANCISCO,
CONCERNING
PUMPS AND WATER AT THEIR PRESENT WORKS, "BUCK'S
SHAFT."

From Letters of P. S. Buckminster, Superintendent.

November 8, 1867.—"At about 65 feet down we cut a small seam of quartz upon the west side of the shaft, the which was dead and porous, and giving (in assay) no traces of gold or silver. The majority of water we have had to contend with came from this seam, and as we have passed it, (trusting it will continue to pitch,) there is reason to hope for better sinking. Yesterday afternoon the water decreased considerably, and to-day there is no increase."

[NOTE.—Struck water in shaft about October 1, 1867; kept under control with tubs.]

November 11, 1867.—"Water continues about the same."

November 13, 1867.—"Have more water again."

November 15, 1867.—"The erection of this pumping machinery will cost not far from \$10,000."

November 25, 1867.—"The water is variable; yesterday less, to-day more, and probably to-morrow there will be less than to-day."

December 6, 1867.—"Are putting in foundations for pump, and will have it all completed by the time the new machinery ordered is received,"

December 9, 1867.—"Water not so strong."

December 10, 1867.—"The water has slackened sufficiently that we are able to sink and timber $1\frac{3}{4}$ ft. a day."

December 18, 1867.—"There has been a decrease in amount of water."

January 7, 1868.—"The rock is the same; and while, for the past two days, there has apparently been a little less water, the difference is hardly enough to be noticeable, or sufficient to base a favorable hope upon as to there being a permanent decrease."

January 14, 1868.—"The amount of water supply and condition of rock have not noticeably changed since last week."

January 21, 1868.—"Having tested the overcoming of this water to my own satisfaction, and believing that if it shall decrease, it will be so very gradual that the benefit to us, before we get the pump erected, will hardly be perceptible, have decided to shut down, if it shall meet the favorable consideration of the President."

February 8, 1868.—"The new shaft we batted over directly we stopped work. To-day I opened and measured, and am delighted to be able to inform you that there is but 35 feet depth of water. (I expected to find 125.) This demonstrates that we have so far no permanent body of water to contend with, only the drain of the surrounding country, and confirms my belief, expressed in former letters, that we may pass it altogether, the which I had despaired of at the time of stopping."

[NOTE.—Most of the time in February and March occupied in laying foundation for pumping engine. Progress slow, owing to cold weather, &c.]

March 20, 1868.—"Have got engine on and set, and all foundation blocks on and set but one, the which will take about three hours to do in the morning."

March 28, 1868.—"Will start Monday morning, and give the water a lively turn one day with the tub. On Tuesday morning will commence setting the pump at the water."

April 2, 1868.—"The water does not go down as fast as I anticipated. It will take, judging from the present, four or five days with the pump and tub to free it. The pump for sinking is 10-inch; that and the tub will send out 300 gallons a minute."

April 6, 1868.—"We started the machinery on Saturday evening. Everything runs very smooth. The water lowered between starting pump time and this morning at 7 o'clock 20 feet. There is now 40 feet of water in shaft, which, at the rate it has lowered since we started pump, will take three days to clear."

April 7, 1868.—"There is now 30 feet of water in shaft, which will require the lowering of pump twice more—once for column and once for both rod and column before we can get to sinking. At the rate we have lowered since yesterday, that should take us 60 hours to complete. This water, which has been collecting, runs back much more freely than I anticipated. Thought we could exhaust the shaft directly, and then take care of the drainage; but such is not the fortune. However, we will soon be free of it."

April 9, 1868.—"When we started bailing, we had about 75 feet of water in the shaft. Before we started the pump we had lowered it with the tub about 15 feet. You will understand that after we stopped, the water, as collected, flowed back into the little watercourses, previously drained, and now we have to re-drain these openings. As near as I could estimate, we at no time, while sinking with tubs, had more than 80 gallons of water per minute. At the time we stopped, I judged it to be about 60 per minute, and we had struck no new seam

for some time, so that, when we get once drained, we should not have more (except what may come from the surface after the rainy season—a liberal allowance for that is 20 gallons, making 80) until we cut some new seam. About the machinery: The engine has a capacity to pump 1,200 feet. I have put down the foundations and commenced with, as system for pumps, size of rods, &c., to go that distance without change. Have started with a rod to first plunge-pump 10-in. square; have started from top with full-sized column in place, so that it can remain when pumps are put in. Am using for sinking a 10-in. diameter pump. It had a capacity of 4-foot stroke; have lengthened its barrel to 6 feet stroke, which gives it a capacity of 24 gallons per stroke, and we can run it, if necessary, to 10 strokes a minute, which gives us between 240 and 250 gallons per minute capacity. We had the water all out this morning ready to send the pump down again, but it comes in too fast yet. Just as soon as we can shift the pump once more without drowning out, we can commence sinking."

April 10, 1868.—"This morning I telegraphed you we had commenced sinking, the pump running 8 strokes per minute to keep free, the which was a falling off since yesterday."

April 12, 1868.—"The pump is running 6 strokes to-day."

April 13, 1868.—"The pumping engine I estimate to, when kept in good running order, be able to raise a 12-inch column of water, (the size of our pumps,) of 1,200 feet height, a distance of 42 feet per minute, which would give us 7 strokes of the pump running full out. Have commenced the erection of pumps with the view of their being kept or erected down as far as the engine will work them. Have projected for plunge-pumps to occur every 250 feet. We now have two."

April 18, 1868.—"About 6 strokes of the pump."

April 20, 1868.—"Water is now down from 4 to 5 strokes of the pump per minute."

May 4, 1868.—"Shaft is down 217 feet. There has been a softer seam come in at the north end, (some 4 inches thick,) which will be of advantage to us in opening up."

May 7, 1868.—"Shaft is down 222 feet. Since striking the soft seam mentioned in previous letter, we have had more water, having to run the pump to 8, and now 7 strokes."

May 15, 1868.—"The water continues plenty; are averaging about 7 strokes of the pump—rather more than less."

May 18, 1868.—"Water plenty; running pump 8 to 8½."

May 20, 1868.—"You will notice by the report that we still have the water as lively as ever—in fact more lively. Next week we shall be down to place of first plunge pump. Am putting in 12-inch lift pump, in order so that if, meantime, the water does not decrease materially, shall swing that for sinking in place of the 10-inch one we are going down with now. Our increased consumption of wood is attributable to increased amount of water. Depth of shaft 248 feet."

May 23, 1868.—“The water is a little more slack, say about a half stroke.”

May 27, 1868.—“Depth of shaft, 265 feet. Average strokes of pump, $8\frac{1}{2}$ per minute.”

May 29, 1868.—“Water in shaft shows no signs of diminishing; consequently there is not much doubt but we shall have to go with 12-inch plunge after first plunge. Have had three buckets give out this forenoon, and consequently lost nearly a full shift.”

June 2, 1868.—“Average run of pump, $8\frac{1}{2}$ strokes. Depth of shaft, 281 feet.”

(Signed)

P. S. BUCKMINSTER,
Superintendent.

From Correspondence of H. H. Day, Superintendent.

June 10, 1868.—“Depth of shaft, 287 feet. I assumed full charge on Monday. Work at shaft is progressing as well as can be expected under the circumstances. We are raising a large amount of water, more than the pump we are using has capacity for. We meet with much delay from two causes: *first*, the pump we are using is a spliced one, having a rough joint, which is destruction on buckets; *second*, there is no clack at the bottom of the pump column to hold the water in the column while we are changing buckets, consequently it all comes back into the shaft, filling it immediately 7 or 8 feet. That, with what is flowing into the shaft, requires sometimes two hours' pumping and bailing before the miners can resume their sinkings. 2 buckets, and sometimes 3, are required daily. I know of no remedy but to push the work. If no accident happens to the pumping machinery within the next two days, the tank and screw drift, with the necessary machinery, will be complete to station the first plunge-pump, and the shaft deep enough to swing the sinking pump for the second lift. That being done, I see no reason why we should not make good progress in sinking.”

June 12, 1868.—“Water is slacking off and rock getting harder.”

June 14, 1868.—“Friday we were occupied in making preparations for putting in two 12-inch pumps, and yesterday (Saturday) morning we commenced by first taking out ten-inch pumps: and the last piece of the 12-inch pumps went down this morning. The connections will be made by two o'clock to-day.”

June 17, 1868.—“The twelve-inch pumps work admirably. I apprehend no more difficulty with water, aside from the inconvenience inevitable to handling so much of it. Do not see that the supply diminishes much.”

June 19, 1868.—“Amount of water about the same as for several weeks past, but we handle it now with all ease. Our pumps work splendid.”

June 21, 1868.—“There is probably an average of 16 inches of water, sometimes more, sometimes less.”

June 25, 1868.—"It would facilitate our sinking considerably if our pump column was in sixteen instead of twelve-feet lengths, as we are compelled to lower the pump for every length of column, consuming from four to six hours at each lowering."

June 30, 1868.—"The water has been very quick for the last week, but seems to be slacking up a little in last twenty-four hours."

July 5, 1868.—"There is no water comes through this rock, and since striking it the water has considerably diminished."

July 8, 1868.—"Average strokes of pump per minute, $4\frac{1}{2}$. Depth of shaft, 327 feet."

July 29, 1868.—"Average strokes of pump, 4."

August 12, 1868.—"Average strokes of pump per minute, 4. Water increasing a little. Lowering pump to-day. Depth of shaft, 367 feet."

August 19, 1868.—"Shaft, 377 feet. Pump strokes, $4\frac{1}{2}$. Water a trifle quicker."

August 26, 1868.—"Strokes of pump, 4. Water a trifle less."

September 9, 1868.—"Pump strokes, 4. Water as last reported."

September 16, 1868.—"Pump on short strokes, average strokes, 7. No change in water."

September 30, 1868.—"Strokes of pump, 6. Water continues about the same."

October 7, 1868.—"Water slacking off. Pump strokes, 4."

December 2, 1868.—"No change in water or pump reports since October 7. Shaft down, 537 feet. Considerable clay is coming in on west side of shaft."

December 9, 1868.—"Average strokes of pump, 2. Water slack."

December 30, 1868.—"No change in water reports."

February 10, 1869.—"Shaft down, 722 feet. Drift started at 700 feet. Average strokes of pump, 2."

NOTE.—Reports concerning pumps and water discontinued until—

October 2, 1869.—"Length of drift, 640 feet. Rock improving."

October 3, 1869.—"Increase of clay."

Strong clay seams running north and south and dipping to the east."

October 4, 1869.—"Small amount of water coming in."

October 16, 1869.—"Large amount of water coming in from face of main drift, which is boarded up at present to prevent a run."

October 17, 1869.—"The flow of water is about as yesterday."

October 21, 1869.—"Large flow of water."

October 22, 1869.—"The pump rod to lower pump broke at 8 o'clock last evening, and has not yet been brought to the surface. One man killed this morning by the cable breaking in the pump shaft. It is difficult to form an estimate of the delay it will occasion us."

October 23, 1869.—"The repairing of pump is progressing satisfactorily, and pumping will probably be resumed to-morrow."

October 24, 1869.—"Repairs to the pump are nearly completed. Will get started up this evening. We have been bailing constantly ever since the break-down, but the water has gained on us to the extent that it will require two days' pumping and bailing to free the

drift of water. Our present flow of water seems to be entirely independent of the water in the old mine, which I regard as indicating the existence of a body of ore to the north, and separate from that worked in the old mine."

October 28, 1869.—"Our progress in main drift is slow, made so by the character of the ground that we are in, and the large amount of water coming in."

November 1, 1869.—"Considerable increase of water in last twenty-four hours."

November 2, 1869.—"Still greater increase of water."

November 6, 1869.—"The water is still rising in shaft, and now stands about 270 feet from the bottom. To bring the surface of the water in the new shaft to the level with the standing water in the old mine will require an additional rise of 200 feet. We are now taking water from the shaft at the rate of 20,000 gallons per hour, and when the new machinery (hoisting) is ready for use, we will increase that amount 10,000 gallons. It is impossible, at this time, to form an intelligent opinion of the time that will be required to free the drifts of water."

November 10, 1869.—"Our misfortunes, in connection with the strike of water in Ophir, seem to follow us up. Last Sunday morning, when our second or lower plunger was covered about 60 feet with the rising flood, it very suddenly ceased to throw water, and is now about 200 feet under water. Unless we can bail it down with the tanks, we will be under the necessity of dropping in an extra pump, which will be a very ugly job. We are building a 500-gallon tank to use with the new engine. With that and the one now in use of 300 gallons will enable us to raise to the surface 16,000 gallons per hour. During the last twelve hours' pumping we did not only check the rising of the water, but actually lowered it in the shaft nine feet. It looks now like we may start the new engine on Monday next. As I stated in my last, it is impossible at this time to form an intelligent opinion of the time necessary to clear the drifts of water. Of one thing I am convinced, however: that is, that our consumption of wood for the next six months will be perfectly *frightful*."

November 25, 1869.—"To-day we succeeded in making our disabled pump work, and at this time it is doing well."

December 1, 1869.—"The pump is working well. The water in the old mine is going down slowly, about 50 feet in all since we tapped the water. In about two days we will have our large tank ready for use, when we will bring our greatest force to bear, and I think will be able to reduce the amount of water quite rapidly."

December 18, 1869.—"Our progress in lowering the water is quite satisfactory. To-day it stands in the new shaft about 220 feet deep, and is settling in the old mine at the average rate of about 3 feet per day. Both tanks and pump are working well."

December 19, 1869.—"We are bending all our energies in our endeavors to free the new works from water, and gaining gradually upon it. To-day we have reached and repaired the lower plunger,

and will connect the drawing lift probably this evening. We have now 200 feet of water in the shaft."

December 21, 1869.—"Water very quick in the shaft, and standing about the same as yesterday, but lowering in the old mine."

December 22, 1869.—"Our water-works are working well. We have reached a point about 200 feet below the surface of the water in the old mine, consequently the pressure is very great, and it just about holds us. It is lowering about 4 feet per day in the old mine, which is quite satisfactory. We are working all our machinery to utmost capacity, consequently accidents are liable to occur, but will guard against them as much as possible."

December 23, 1869.—"Water in new shaft about as yesterday, but lowering in old mine."

December 24, 1869.—"I assure you there will be no let-up, and I believe few drawbacks, until we have the water well under control."

December 25, 1869.—"We have just succeeded in completing repairs to the lower plunger or middle pump, and made connection with the lower pump. Water at this point has been very strong: in fact it has held us for several days. In old mine to-day the water is about 30 feet below the seventh level, having settled from the seventh during the last week."

December 27, 1869.—"Yesterday evening we had the water at a point lower in the shaft than at any previous time; but immediately after the first earthquake shock it came up in the shaft some 25 or 30 feet in a short time. At this time we have nearly recovered the lost ground. The earthquake did us no damage. Both tanks and pump are working well. Water in old mine continues to lower at the rate of 4 or 5 feet per day."

December 28, 1869.—"We have the water down 25 feet below lower plunge pump, which leaves 175 feet in shaft."

December 29, 1869.—"Water in shaft to-day 165 feet. The amount of water coming into the shaft has increased very much since the occurrence of the earthquake, seemingly from other sources than the old mine."

December 30, 1869.—"The earthquake shocks last night increased the water very perceptibly."

December 31, 1869.—"Water in shaft has gained on us a trifle in the last twenty-four hours. I am pleased to be able to report to you a decided gain upon the water to-day—155 feet from the bottom; but it is very stubborn, and requires heavy and persistent work. I have no doubts as to the result."

January 4, 1870.—"Water in shaft 145 feet, and very strong."

January 5, 1870.—"We are crowding the work steadily in the shaft to-day. We have only 130 feet of water, which is a reduction of 15 feet in last twenty-four hours."

January 6, 1870.—"Water in shaft to-day stands about the same point it did yesterday. It came in very rapidly last night, and notwithstanding we were raising our usual quantity, gained on us some

15 or 20 feet; but we have about regained it to-day. The flow from the old mine does not seem to be uniform. That probably will be the case until the amount in the old mine is about exhausted."

January 7, 1870.—"Water in shaft is but a trifle lower than yesterday. It seems to be very strong at this point."

January 10, 1870.—"Since my last we had the misfortune to lose one of our large tanks, which occasioned a few hours' delay only in bailing with one tank, as we had another large tank which required a few hours' repairs, when bailing was resumed, and is going on as usual, holding the water at about the same point as when last reported."

January 11, 1870.—"Our water-works are doing as well as usual, but the water holds us very stubbornly at this place."

January 12, 1870.—"We do not succeed in getting the water in the shaft any lower than heretofore reported. It is lowering in the old mine at the rate of one foot and a half per day; not half so fast as previous to the earthquakes. I think it probable that the increase of water caused by the earthquakes will soon subside."

January 13, 1870.—"I am able to report to-day that we have reached a point in the shaft 585 feet down, leaving 115 feet yet to the drift. We are so much below the surface of the water in the old mine, that a rush of water from the old to the new works is liable to occur at any time, which may fill the shaft in a few hours 50 or 60 feet. All our machinery is working as well as could be desired."

January 14, 1870.—"Water in shaft is a few feet lower to-day than yesterday. Water in old mine has gone down in last forty-eight hours 3 feet and 8 inches."

January 15, 1870.—"I am pleased to report to-day 105 feet of water in shaft, but very strong at that point, and going down but slowly. All our machinery is working well, and up to full capacity."

January 17, 1870.—"We are still making vigorous battle with the water, and driving it slowly down. We have it now within 110 feet of the bottom. In last four days it has lowered in old mine 7 feet. I think the increase of water caused by the earthquake is beginning to subside. If so, we will be able to make more rapid progress in the future."

January 18, 1870.—"Water in shaft about as yesterday."

January 19, 1870.—"To-day the water in old mine stands 424 feet from surface, and just 200 feet from bottom or tenth station. The total lowering of water in old mine to date is 110 feet, and going down very regularly from 21 to 24 inches every twenty-four hours. The drift from new shaft is 425 feet below surface of water in old mine, and the water stands in new shaft to-day about 100 feet from the bottom. We find that we are able to keep the water in shaft from 300 to 325 feet below the surface of water in old mine; hence I conclude, that when the water lowers in the old mine 100 feet more, we will be able to free the new works of water."

January 20, 1870.—"Water in shaft 95 feet; going down slowly."

January 21, 1870.—"90 feet of water in shaft to-day; gradually, but slowly, pushing towards our drift."

January 22, 1870.—"There is no change to note in depth of water at either mine since my last, notwithstanding we are raising the usual amount. An additional supply seems to be coming from some quarter; probably it is only temporary."

January 24, 1870.—"In last forty-eight hours the water in old mine has lowered $3\frac{1}{2}$ feet: but at the new shaft it stands about 90 feet from the bottom."

January 25, 1870.—"Owing to some delay in repairing tanks the water is considerably up in the shaft. In old mine it has lowered in last twenty-four hours 20 inches."

January 26, 1870.—"Water in shaft about as reported yesterday; has lowered in old mine in last twenty-four hours 18 inches."

January 27, 1870.—"Water in old mine has lowered since last report 18 inches. In new shaft it stands about as yesterday."

January 28, 1870.—"We have 95 feet of water in shaft to-day. A careful measurement of water in the old mine to-day shows it to be 434 feet from surface, and 190 feet from bottom of tenth section. We do not make rapid progress; but we do gain, and hold all that we get, which is encouraging, and shows that it is entirely a question of time as to when the new works will be cleared of water."

January 29, 1870.—"I am pleased to report to-day only 78 feet of water in shaft, and a lowering in old mine last twenty-four hours of 18 inches."

January 31, 1870.—"Mount Davidson has been shaking again, and consequently the Ophir water has increased as usual in such cases. Sunday morning there was only 74 feet of water in shaft, and going down nicely. To-day there is 95 feet, notwithstanding pumping and bailing has been going on without any interruption."

February 1, 1870.—"Water in shaft stands about as yesterday. Since Saturday the water in the old mine has lowered 3 feet."

February 2, 1870.—"We have 100 feet of water in shaft to-day; but there is an increased lowering in the old mine of $2\frac{1}{2}$ feet in last twenty-four hours."

February 3, 1870.—"There was some delay last night both with pump and large tank, consequently the water in shaft is higher to-day than usual. Everything is working well now, and the water is being lowered quite rapidly. In the old mine last twenty-four hours the water lowered 1 foot."

February 4, 1870.—"I am pleased to report a more rapid lowering of water in the old mine than heretofore. A correct measurement made to-day, from surface down to water, shows a lowering for the last week of 14 feet. In consequence the water in new shaft is stronger than usual. It holds us at about 600 feet from surface the last few days."

February 5, 1870.—"Notwithstanding pumping and bailing has been going on as usual for the last twenty-four hours, there has been but slight progress made in lowering the water."

February 7, 1870.—"We have to-day a little less than 100 feet of water in shaft. In old mine the water has lowered in last twenty-four hours $3\frac{1}{2}$ feet, showing conclusively to my mind that in time we will conquer."

February 8, 1870.—"Water in shaft about as yesterday. In old shaft it has lowered in last twenty-four hours 15 inches."

February 9, 1870.—"Water in No. 1 (new shaft) about as yesterday."

February 10, 1870.—"Water in No. 1 about as last reported. In old mine it has lowered in last twenty-four hours 15 inches."

February 11, 1870.—"Water in No. 1 about as yesterday. It seems much stronger than last week. In old mine it has only lowered 12 inches in last twenty-four hours."

February 12, 1870.—"Water at No. 1 at 600-foot station. It sticks to that point with great tenacity; but we are bound to get the best of it in time. We will be compelled to stop our large tank about three days next week to refill the large cog-wheel."

February 14, 1870.—"This water is a monster elephant, but I know we can handle him; but it won't do to relax in the least the grip we have on it. In No. 1 the water is about 150 feet; in old mine it has lowered in last forty-eight hours 3 feet."

February 15, 1870.—"Water in No. 1 160 feet; filling wheel will be completed this evening. Water in old mine has lowered in last twenty-four hours 1 foot."

February 16, 1870.—"We have everything in complete running order."

February 17, 1870.—"100 feet of water in No. 1 to-day."

February 18, 1870.—"Water in No. 1 ninety feet. Owing to broken timbers, or some other obstruction, we cannot get on satisfactory in the old shaft since Wednesday."

February 19, 1870.—"We have only 85 feet of water in No. 1 to-day."

February 21, 1870.—"Water in No. 1 82 feet, and very lively. Everything working right up to the utmost capacity; measurements of water in old shaft not satisfactory."

February 22, 1870.—"Water in No. 1 80 feet."

February 24, 1870.—"I am pleased to report only 60 feet of water in shaft No. 1."

February 25, 1870.—"Water in No. 1 65 feet to-day; lowered in old shaft in last twenty-four hours 18 inches."

February 26, 1870.—"Water in No. 1 to-day is only 54 feet in depth. It has lowered in old shaft in last twenty-four hours 15 inches."

February 28, 1870.—"Water in No. 1 about as reported on Saturday."

March 1, 1870.—"There is 53 feet of water in No. 1 to-day."

March 3, 1870.—"To-day there is only 50 feet of water in No. 1."

March 4, 1870.—"We are repairing again to-day at shaft No. 1. About one-half the cogs in large wheel gave out last night; pump and

small tank running as usual; will probably have everything in good running order to-morrow evening."

March 5, 1870.—"The repairs at shaft No. 1 spoken of yesterday are completed, and machinery moving as usual; 150 feet of water in No. 1."

March 7, 1870.—"Water in No. 1 is down to 75 feet."

March 8, 1870.—"I am pleased to report only 60 feet of water in No. 1, and being lowered steadily."

March 10, 1870.—"52 feet of water in No. 1 to-day."

March 11, 1870.—"Water in No. 1 about as yesterday; machinery working well."

March 12, 1870.—"I can report to-day only 50 feet of water in No. 1."

March 17, 1870.—"Water in No. 1 about as yesterday, (60 feet;) rather strong of late."

March 18, 1870.—"Water in No. 1 65 feet."

March 19, 1870.—"Water in No. 1 is about as yesterday. The water seems stronger on this level than two weeks ago. Whether it is coming through faster from the old mine than then I am unable to say. I do not think there is an actual increase. A week or two will determine that point."

March 21, 1870.—"The bucket to our lower pump has been failing for the last few days. This afternoon I concluded to take it out, if possible. It being one of those patent-ring buckets, we have had doubts as to its coming through the column. It is now being brought up slowly. If we succeed in replacing it with a newly-dressed bucket, there will be but little delay in pumping. Should we not succeed in this, an extra pump, which we have in readiness, will have to be lowered, which will cause, at most, only a few days' delay. Both tanks, meantime, will be kept running."

March 22, 1870.—"At No. 1 we have not succeeded in drawing bucket from lower pump; have commenced active preparations for putting in extra pump."

March 24, 1870.—"There is to-day 100 feet of water in No. 1; lower pump working to about half capacity. Preparations are going on for putting in extra pump. We may conclude to refill our large wheel before lowering pump, as, while the change of pumps is being made, much will depend upon the tanks to hold the water at as low a point as possible."

March 25, 1870.—"90 feet of water in No. 1 to-day. I note what you say about using telegraph to inform your office of accidents to machinery. I did not consider the partial giving out of a pump-bucket, the packing of a cylinder or piston-rod, cleaning of boilers, &c., &c., as being drawbacks of sufficient importance to demand the use of the telegraph; but I will be pleased to comply with your views in the matter."

March 26, 1870.—"Water to-day in No. 1 is about 80 feet; will commence filling large cog-wheel this evening, as it is of the greatest importance that this wheel shall be in good condition at the

time we are lowering our pump, as everything will depend upon the tanks to keep the water at as low a point as possible while that is being done. You can assure Ophir stockholders that we are doing all in our power to reduce this water. Delays to some extent are unavoidable. There is no time when there is not a large stream of water coming to the surface at Ophir shaft, and it must tell before long."

March 28, 1870.—"At shaft No. 1 the large cog-wheel is completed, and the engine running. Preparations for lowering pumps are progressing."

March 29, 1870.—"Water is 100 feet deep; will get ready to commence lowering pump on Thursday."

March 31, 1870.—"Have just commenced lowering pump. Putting this pump in place is attended with so many difficulties, that it is impossible to say, with much certainty, the length of time that will be required, but probably about three days."

April 1, 1870.—"At shaft No. 1 we are still engaged in putting down pump; getting along very well; foundation to pump-bob is becoming a little shaky, and it may be necessary to overhaul it before making our next great effort at lowering the water."

April 2, 1870.—"We are working this afternoon lowering pump at shaft No. 1. I think by to-morrow night we will have it all in, and connections made."

April 4, 1870.—"At shaft No. 1 we have the pump in place and ready to start; but, owing to repairs on bob foundation, will not start until to-morrow evening."

April 5, 1870.—"Started pump this afternoon; it works well. There is to-day one 120 feet of water in the shaft."

April 6, 1870.—"Water in shaft No. 1 is only 20 feet from bottom of drift."

April 7, 1870.—"At shaft No. 1 water is about 15 feet. We are lowering pump this afternoon. This lowering will enable us to renew the bucket in the pump and resume work with same. I think the backbone of the water is broken, and I have no doubt but ten days, or two weeks at most, will let us into the drift."

April 8, 1870.—"At shaft No. 1 the pump was started at noon to-day. Water is now down at the same point as at this time yesterday; expect to see inside of drift to-morrow."

April 9, 1870.—"At shaft No. 1 we have repaired old pump, and it is doing good work. Water is down to about two feet below top of drift. There is a large body of water at this point, but everything looks favorable for getting into the drift in a few days."

April 11, 1870.—"At shaft No. 1 the drift is free of water; have taken off small tank this afternoon and put on cage: the pump, and large tank, keeping the water down with ease. We find the drift in fair condition. And right here allow me, most sincerely, to tender you, as president of the Ophir S. M. Co., and your associate trustees, my heartfelt thanks for the generous co-operation with which you have sustained me in this fight; for truly a battle it has been of no ordi-

nary magnitude, and I feel that a great weight of anxiety and responsibility has been removed."

April 12, 1870.—"Pump and large tank control the water with ease."

April 18, 1870.—"The water seems to be falling off. There is still a large flow coming in, but it is handled with ease."

April 19, 1870.—"Water is steadily decreasing."

April 21, 1870.—"The water is becoming less every day, and from present appearances I think, within two or three days, the pump will take it easy."

April 22, 1870.—"Water is about as yesterday."

April 26, 1870.—"Do not see much difference in the amount of water coming in in the last few days."

April 28, 1870.—"Water about as last reported."

April 30, 1870.—"No apparent change in amount of water."

May 2, 1870.—"At shaft No. 1 the water is stronger than for the last few days."

May 3, 1870.—"Amount of water about as last reported."

May 5, 1870.—"Water continues about the same as last reported."

May 6, 1870.—"At shaft No. 1, main drift is still in hard porphyry, with an increase of water coming in."

May 7, 1870.—"Increase of water referred to yesterday still continues, but I have no fears of being flooded."

May 9, 1870.—"Water is about as last reported."

May 12, 1870.—"Water holds about the same."

May 13, 1870.—"The main pump-rod broke this forenoon. There is a possibility that the drifts will fill with water, as one of the tanks is used much of the time for men to go up and down on in the work of repairing. Think the pump will not be laid up longer than tomorrow noon."

May 14, 1870.—"At shaft No. 1 pump is again in good order. Started up early this morning."

May 16, 1870.—"Water about as last reported."

May 17, 1870.—"The water seems a little stronger to-day."

May 19, 1870.—"The water does not seem to fall off any of late."

May 20, 1870.—"No change in amount of water."

May 21, 1870.—"The water appears to be slacking off a little in last 24 hours."

May 23, 1870.—"Water is about as last reported."

May 24, 1870.—"No change in amount of water."

May 26, 1870.—"At shaft No. 1 main drift is in soft running ground, but no quartz. Quite an increase of water."

May 27, 1870.—"In soft ground. Water is increasing."

May 28, 1870.—"Drift is in hard blasting porphyry. Water is not quite as strong as yesterday."

May 30, 1870.—"Water is about the same as last reported."

May 31, 1870.—"Water is falling off somewhat in last 24 hours, but still requires the use of one tank with the pump much of the time."

June 2, 1870.—"Water is somewhat less than last reported."

June 3, 1870.—"Last night, about midnight, the irons on one end of our Pitman rod broke, which renders our pump useless until repaired, which will not be before to-morrow morning. Consequently our drifts are filling with water, but I do not apprehend any serious damage to them."

June 4, 1870.—"Started pump this morning at 7 o'clock. Will have large tank running this evening. The drifts are now full of water, but will probably have them free on Monday morning."

June 6, 1870.—"Work is again going on as usual. The only damage from the late flood was the breaking of a few lengths of air-pipe, &c."

June 7, 1870.—"Water is about as last reported."

June 9, 1870.—"The pump is laid up to-day, owing to the breaking of some of the upper gearing last night. Will have it repaired temporarily by to-morrow morning. To repair it permanently, a new sole-plate will have to be made for the pillow-block under the crank end of the main gear-shaft. Meantime both tanks are running, but the water is slowly filling the drifts."

June 10, 1870.—"At shaft No. 1 pumping machinery is very much demoralized. Instead of the main gear-shaft being sprung, as I telegraphed you this morning, we find on taking it out that it is very badly broken. We have been fortunate in securing one of proper size from the Gould and Curry Co., which we will put in place with all possible despatch. The very best that we can do, it will probably require ten or twelve days before we can regain the ends of our drifts and resume work. I regret this very much, but do not see any way by which this accident could have been foreseen or avoided."

June 13, 1870.—"At shaft No. 1 we are making good progress in repairing machinery, and when it is started up this time, I think it will be in better condition to do the work required than ever before. Notwithstanding the large tank is kept constantly running, there is at this time 125 feet of water in the shaft."

June 14, 1870.—"Depth of water 150 feet."

June 16, 1870.—"Water is 175 feet in depth, and slowly rising. Work of repairing is well under way. Will start pump about Monday next."

June 17, 1870.—"Water seems to be at a stand still. Will have both tanks running this evening, and the pump on Monday, when I think we will make short work with the water."

June 18, 1870.—"Have lowered the water 25 feet in last 24 hours."

June 20, 1870.—"Pump started last evening at 7 o'clock. The water is now lowered to a depth of 60 feet. Will have the water out of the drifts by Thursday morning."

June 21, 1870.—"The water is 30 feet in depth. Both tanks and pump are running."

June 23, 1870.—"Drifters resumed work at noon to-day."

July 8, 1870.—"Quite a stream of water is coming in face of drift to-day."

July 11, 1870.—"There is quite an increase of water."

July 16, 1870.—"As soon as the pump will handle the water, two engineers will be dispensed with, but at present we have to do a good deal of bailing with the large tank."

July 18, 1870.—"The amount of water is falling off a little in the last few days."

July 19, 1870.—"Water is gradually falling off, and we hope soon to be able to handle it with the pump alone."

July 25, 1870.—"Water is about as last reported."

July 26, 1870.—"Water is gradually growing less."

July 29, 1870.—"The water has decreased to an amount that the pump can handle, which allows us to dispense with two engineers, and also reduces the amount of wood consumed."

August 1, 1870.—"North drift is getting softer, with some water coming in."

August 4, 1870.—"In north drift there is quite a flow of water coming in."

August 5, 1870.—"The water in north drift, referred to yesterday, is rapidly drying up."

August 6, 1870.—"The amount of water is growing less daily."

September 2, 1870.—"The water is wholly within control of the pump. We are liable to have an increase of water from southwest drift No. 1 at any time."

October 26, 1870.—"With the exception of a slight increase of water in the north drift, there is no change to note in the appearance of the drifts."

November 3, 1870.—"An increased amount of water is coming in from southwest drift No. 1."

February 15, 1871.—"In the upraise have struck a small stream of water, which, if it increases, will give us some trouble."

February 16, 1871.—"In the upraise there is a slight increase of water to-day, somewhat impeding progress of work."

February 17, 1871.—"Water is still coming in in the upraise."

February 18, 1871.—"A small amount of water is still coming in."

February 20, 1871.—"Water in upraise continues about the same, and occasions some trouble in the work."

February 21, 1871.—"Have an increase of water in the upraise to-day."

February 23, 1871.—"In the upraise, about the same amount of water is coming in."

February 25, 1871.—"The usual amount of water is coming in."

February 28, 1871.—"No change in amount of water."

March 1, 1871.—"In the upraise there is quite an increase of water to-day, which is giving us some trouble, and may delay progress for some days."

March 3, 1871.—"Water continues the same as the past few days."

March 4, 1871.—"The upraise is to-day up 270 feet, with water enough coming in to make it exceedingly troublesome."

- March 6, 1871.*—"No change in amount of water."
- March 7, 1871.*—"Amount of water continues unchanged."
- March 8, 1871.*—"A considerable amount of water is still coming in."
- March 9, 1871.*—"No change in amount of water."
- March 10, 1871.*—"A considerable amount of water is coming in."
- March 11, 1871.*—"Rock and water continue about the same as yesterday."
- March 13, 1871.*—"Water continues somewhat troublesome."
- March 14, 1871.*—"Water continues the same."
- March 15, 1871.*—"We have now reached the top of the upraise. Will suspend progress for a few days in order to thoroughly drain the incline before we proceed to drift."
- March 16, 1871.*—"Work of cleaning and repairing timbers in the upraise is still being prosecuted. The amount of water coming in causes considerable delay in progress."
- March 18, 1871.*—"Volume of water coming in continues unchanged."
- March 20, 1871.*—"Water continues troublesome."
- March 21, 1871.*—"Water in upraise seems to be falling off."
- March 22, 1871.*—"Water gradually decreasing."
- March 23, 1871.*—"Water continues about the same as last reported."
- March 24, 1871.*—"Water continues without change."
- April 5, 1871.*—"Water in upraise is pretty well drained out."
- April 17, 1871.*—"The winze is down 40 feet. A very little water is coming in, but as yet is all absorbed by the material coming out."
- April 18, 1871.*—"Will resume work in cross-cut from the upraise to-morrow. In the winze about the same amount of water is coming in."
- April 19, 1871.*—"Water is a little troublesome."
- April 20, 1871.*—"There is no change to report from the winze, only an increase of water, and a very little more will drive us out."
- April 21, 1871.*—"It looks like the water will soon get the best of us in the winze, and it is probable that work at this point will be stopped in a day or two."
- April 22, 1871.*—"Water about as last reported."
- April 24, 1871.*—"Ground cut in the winze is about as heretofore reported, with no diminution of water."
- April 26, 1871.*—"One new plunger pump and 200 feet of new main pump rod completes the preparations, and I would recommend to the trustees that it is advisable that sinking of the main shaft be resumed at as early a day as possible."
- May 5, 1871.*—"Work of prospecting is suspended, owing to breaking of spur-wheel of pumping engine, which gave out this morning. The new wheel, ordered from the foundry, being not quite completed, it may be Monday or Tuesday before work can be resumed in the mine. Meanwhile the water is kept in check by the tanks."

May 8, 1871.—“Spur-wheel for pumping engine is completed and in place, and pump started up this morning. Will lower the water so as to resume operations below to-morrow morning.”

May 9, 1871.—“Work was resumed below to-day at noon. The new spur-wheel works well. Will be able to keep the water under control with pump alone.”

May 11, 1871.—“Raising column of old extra pump to the surface, and making arrangements for lowering new plunge-pump.

May 16, 1871.—“Preparations for sinking are progressing satisfactorily. The new plunge-pump is about completed, and will soon be in operation.”

May 22, 1871.—“The new pump is being placed in position to-day, and will soon be in working order.”

May 25, 1871.—“Pump was started up this morning, and everything is working well. It will probably take a couple of days to lower the water, when, as soon as the sump can be cleaned out, sinking will be resumed.”

May 29, 1871.—“Will probably finish cleaning out the sump to-night, and will soon be ready to resume sinking.”

June 1, 1871.—“We are making fair progress in sinking.”

July 6, 1871.—“At the shaft have struck quite a stream of water to-day, which somewhat delays progress in sinking. It will probably soon exhaust itself and dry up naturally.”

July 10, 1871.—“Are now in blasting ground. The water occasions no delay.”

July 22, 1871.—“Have had considerable increase of water in the last few days. Rock is not very hard, only requiring an occasional blast.”

August 1, 1871.—“Please order and have shipped without delay 360 feet 10-inch pump column.”

October 11, 1871.—We have put in place, 900 feet down in the shaft, one plunge-pump, and have made all the necessary connection; have taken out about 100 feet of the upper section of the main pump-rod, and replaced it with new and larger rod, the old rod being 10 by 10, and the new 12 by 12 in.

November 25, 1871.—“We are opening a station at 1,100: that is preparatory to drifting. We are also excavating for a large pump-tank at this station.”

December 9, 1871.—“Excavation for tank at this station (1,100) is completed, and framework for tank is being put in to-day.”

(Signed)

H. H. DAY,

Superintendent.

From Correspondence of Philipp Deidesheimer, Superintendent.

January 2, 1872.—“In compliance with your instructions of the 20th ultimo, I took possession on that day of the Ophir mine. The machinery is generally in good order. There are three 12-inch

plunger-pumps, and one of 10 inches in service, and the fifth one, 10 inches, is under construction, and will be ready to put in place as soon as needed. We are raising about 146,000 gallons of water per 24 hours. The pumping engine is of 18-in. bore, by 42 inches stroke, but requires re-boring of the cylinder and general overhauling; but can be made, at little expense, to answer the purpose for some time."

January 22, 1872.—"We are still busy placing pumps, and will complete this work by Tuesday, and bobs by Thursday night. You will please remember that we will be obliged to re-bore pump engine, &c. All this takes time and labor, but shall try to have all completed about the 5th of February."

January 29, 1872.—"Quite a number of men were employed to assist Pitman, getting pump-shaft in better condition. For once this department is in good working order; the consumption of wood will be reduced over 30 per cent. from what it was heretofore. The pumping time is now 13 instead of 19 hours, with same flow of water."

February 5, 1872.—"The sluices to conduct the water across the lode on the 700-foot level will be in place by this evening, and the repairs to the machinery, &c., will be finished this week."

February 12, 1872.—"This morning we commenced overhauling pump engine, and find it in a very bad condition, but will be again in working order by next Friday."

February 13, 1872.—"You are aware the pump engine is under repairs, and the water, being within 50 feet of the 1,100-foot level, obliged me to stop the drift on that level at 250 feet, as we are compelled to use both hoisting engines, hoisting the water with the tanks to the surface; but I think we will be able to resume work in the drift by next Thursday. I have ordered 250 feet 12 by 12 inches new pump rods to be made, as occasionally one breaks, causing great delay."

February 20, 1872.—"We have finished the wood-work on the 250 feet of pump rods, and are awaiting the iron which has been ordered from San Francisco, and as soon as it arrives will get the new rods in place. Everything else working well."

(Signed)

PHILIPP DEIDESHEIMER,

Superintendent.

VIRGINIA CITY, NEVADA, February 22, 1872.

OFFICE OPHIR SILVER MINING COMPANY,
VIRGINIA CITY, March 13, 1872.

Cost of Ophir new shaft from August, 1867, to January 1, 1872, including pumps, bobs, air-conductors, and all underground work and machinery-----	\$415,936 09
Cost of building, over-shaft -----	7,159 03
Cost of machinery account, including labor and material. -----	172,541 35
General expense account: salaries and office expenses, &c., August 1, 1867, to Jan'y 1, 1872, \$38,824 32: one-half applied to cost of new works -----	19,412 16
Total cost of new works, "Buck's shaft," from time of breaking ground, August, 1867, to January 1, 1872 -----	<u>\$615,048 63</u>

Dimensions of shaft, outside of timbers: 18 ft. 8 in. by 7 ft. 4 in.
Depth of shaft, January 1, 1872 ----- 1255 feet.
No. of feet of drift and winze to Jan'y 1, 1872----- 2900 "

Actual cost of pumping for month of January, 1872.

Pitman's wages-----	\$170 50
$\frac{1}{2}$ engineer's " -----	311 00
$\frac{1}{2}$ fireman's " -----	124 00
$\frac{3}{4}$ wood-hauler's -----	93 00
$\frac{3}{4}$ am't of wood consumed, 141 cords, at \$10-----	1,410 00
$\frac{1}{2}$ " " oil and tallow " -----	11 25
Interest on cost of pumping machinery to date, \$36,351, at 1 per cent. per month.-----	363 51
Total amount-----	<u>2,483 26</u>
Less value of water used by the Co., furnished by Water Co., in payment for water raised from shaft---	600 00
Net cost for January, 1872 -----	<u>\$1,883 26</u>

OFFICE OPHIR SILVER MINING COMPANY,
VIRGINIA CITY, March 13, 1872.

The indirect cost of raising water was *estimated*, in our statement of February 16, as about \$3,000 for January.

Upon close examination of January account we find, in addition to the direct cost as shown, (\$2,483 26,) machinery expense amounting to \$408 85. Total amount, \$2,892 11. Indirect cost, \$3,000 00.

Our current expenses would be lessened this amount, had we no water to contend with.

Total mine expense for January, 1872, \$11,055 46.

OFFICE OPHIR SILVER MINING COMPANY,

Virginia City, March 13, 1872.

STATE OF NEVADA, } ss:
 County of Storey, }

We hereby certify that the accompanying statements and figures are materially correct, as shown by the books in this office, and also that the extracts inclosed embrace all that is mentioned in letters of superintendents of the Ophir Silver Mining Company to the office of the company in San Francisco, concerning pumps and water, within the dates therein given.

PHILIPP DEIDSHEIMER,

Superintendent Ophir Silver Mining Company.

G. F. FORD,

Clerk Ophir Silver Mining Company.

Subscribed and sworn to this fourteenth day of March, A. D. 1872, before me.

[L. s.]

WILL H. BURRALL, *Notary Public.*

THE DISCUSSION.

WASHINGTON, April 15, 1872.

The Committee on Mines and Mining of the United States House of Representatives met at 7½ o'clock.

The committee was convened for the purpose of hearing arguments *pro* and *con*. regarding the proposed loan by the Government in the construction of the Sutro tunnel.

The committee was called to order by the chairman, Hon. HENRY WALDRON. The chairman then said:

Mr. Sutro, I believe you are entitled to the opening.

Mr. RICE. Mr. Chairman and gentlemen of the committee: Under our practice in New England the opening statement is always made at the commencement of the trial or hearing of a cause.

The evidence on behalf of the party holding the affirmative of the issue is then introduced. When such evidence has been concluded, the party defendant presents his case. Then the closing arguments are submitted, first by the defendant and then the plaintiff. I do not know what the rule is here.

I did design to make some very brief opening remarks, but have concluded, as Mr. Sutro is so very familiar with this matter, and inasmuch as we understand Mr. Sunderland has some motion to submit, to waive any opening, and give the evening to Mr. Sunderland. I believe it was understood that he was to have three hours. Whether—

Mr. SHOBER. Not to exceed that.

Mr. RICE. Not to exceed that. You are right. Whether either party will want as much as that I am not aware, but we are willing to waive the opening.

Mr. SUNDERLAND. Mr. Chairman, I had not designed opening the case at all for the remonstrants against the tunnel this evening, and so announced to Mr. Sutro. As we were each to be allowed three hours by the decision of the

committee, I told him that after the opening this evening, which he informed me would be short, I would content myself with one hour on Wednesday evening, instead of three. As there is to be no opening this evening, I have no objection to making the motions which I contemplated making, and to which I called the attention of the sub-committee.

Mr. SUTRO. Do we understand you to say, Mr. Sunderland, that you do not propose to make any argument to-night?

Mr. SUNDERLAND. That is what I said.

Mr. SUTRO. We would not propose to occupy more than half an hour in the opening, if we were to make an opening argument at all; and I do not see how we are to get three hours, if Mr. Sunderland is going to occupy a portion of the next evening.

Mr. SUNDERLAND. The first motion I have to make is, to exclude from the record of testimony what purport to be extracts from letters from the superintendents of the Ophir mine to the company's office in San Francisco.

It will not be disputed that I objected to them, and that they were admitted by the sub-committee against my protest. After the examination of the three commissioners, it was determined by the sub-committee to hear no testimony unless it was under oath. At the last meeting of that committee Mr. Sutro presented these papers here, which purport to be extracts from letters, running through from November 8, 1867, until February 22, 1872. The foundation, or rather the object, of the rule adopted by the sub-committee, I suppose, was first to get the truth from the statement of the witnesses, and the privilege was extended to the other side to cross-examine the witnesses. There is another rule in law, well known to every lawyer, which would exclude them, and that is, that no part of a document—an original document—can be offered in evidence unless the whole of it is offered; and for this reason, that the extract that you may read from the letter or paper may not of itself explain itself. Therefore, when any part

of a paper of any kind is offered in evidence, the whole must be submitted to the court.

Now, these are extracts, in some cases, of a single line. What else was there in that letter? The papers do not purport to be complete copies of letters, but simply extracts, and it may be that in the balance of the letters from which these extracts are made there may be statements explanatory of what is contained in the extracts here presented.

Again: it is objectionable, on the ground that the letters are traced to the office of the company in San Francisco, and no effort has been made to procure these original letters. There is another rule perfectly well settled, that in all cases, before you can offer evidence of the contents of a letter or paper, you must take such steps to procure the original as may be in your power.

Now, there is no question, I suppose, but that, at the request of the superintendent, who makes an affidavit here, or at the request of the Sutro Tunnel Company, these original letters could have been had, and that they would have been sent here for use before this committee.

Again: there is another objection, which of itself must be fatal to the introduction of these extracts, and which is, that they do not purport to be copies of letters, but copies of copies, which no court of law ever admitted. They purport to be copies, or extracts of copies, of letters that remain in the office of the superintendent in the City of Virginia. Why were not these copies sent, if the originals could not be procured? And what foundation is there for the introduction even of copies? Certainly none recognized by law, or any rules of evidence; because, when you offer to prove the contents of a paper, you first show your inability to procure the original, and then you prove it by the testimony, and subject to cross-examination in open court the witness who has compared the original with the copy. But copies of copies never were introduced anywhere. Mr. Deidesheimer and Mr. Ford, the first superintendent and the second clerk of the Ophir company, at the mine, certify

that "the accompanying statements and figures are materially correct, as shown by the books in this office; and also that the extracts inclosed embrace all that is mentioned in letters of the superintendents of the Ophir Silver Mining Company to the office of the company in San Francisco concerning pumps and water, within the dates therein given. Subscribed and sworn on the 14th of March."

That is the only foundation for the introduction of these documents, and certainly, after the determination of the sub-committee to hear no testimony except that under oath, and where the party opposed to the side introducing the witness could have an opportunity to cross-examine the witness, the paper here should have been excluded from the committee. I therefore appeal from the decision of the sub-committee to the committee, and ask that these papers shall be ruled out.

If you want me to make the other motion now, I will do so.

Mr. RICE. Which other motion?

Mr. SUNDERLAND. I refer to the motion regarding the decision of the committee in reference to the stock of the Sutro Tunnel Company. Perhaps, though, it would be best to dispose of this first.

Mr. RICE. One word preliminary here, Mr. Chairman and gentlemen.

The CHAIRMAN. Was it not the understanding at the last meeting that Mr. Sunderland might incorporate in his remarks any objections he had to the admission of testimony, and such would be passed upon with the other matters?

Mr. RICE. I was about to remark, that that was my understanding. As I understood it, Mr. Sunderland would submit his motion, and comment thereon as he should proceed in his argument, and that during our argument we would reply. And what I rose to inquire was, whether Mr. Sunderland intends what he has said to be considered as part of his argument, and whether he is going on with it to-night or not.

Mr. SUNDERLAND. Mr. Chairman, it was only to save

time, as the gentlemen on the other side have declined to make any opening at all, which seems to me rather a strange proceeding.

Mr. RICE. We do not object, but said we wanted it. We leave it entirely to the committee. If they require an opening, we will make it.

Mr. SUNDERLAND. I do not know what I am to answer until I know what is said. Where a party appears as plaintiff, or where a party appears before a committee, and asks something positively to be done by that committee, such as recommending an appropriation of money by Congress, it would seem to me to be very proper for that party to assign some reason for the appropriation; and if no reason is assigned, why the inference may be that there is no reason that can be assigned. I certainly do not know what to answer, until some argument or some reason is urged upon this committee why this appropriation should be made.

Mr. RICE. If there is any disagreement between Mr. Sunderland and myself, it is owing to the different methods of practice in various parts of the country. As I said before, in my own country—in New England, Massachusetts, and Maine—the party holding the affirmative always opens the case in the beginning. That I understood Mr. Sutro to do when we commenced his case. Then the evidence is put in. Then the defendant makes his opening, and puts in his evidence. Then the defendant makes his closing argument, and then the plaintiff his. That is our universal practice; but the practice differs in different parts of the country. Now, if it is insisted that we must put in an opening argument here, or if desired even, why I have no objection to going on a short time and state the grounds, with the position we occupy, although it was stated fully in a long speech by Mr. Sutro at the beginning of the case, he taking up the whole meeting. Therefore I suppose there is no sort of doubt as to what we ask here, and how we propose to get it. And we are not here really like parties in court, may it please the committee, by any means.

The Government is the principal party. To be sure there are other parties interested. On the one side are the parties which I represent in part, in connection with Mr. Sutro; and on the other the Bank of California, or the owners of these mines, whoever they may be, or anybody in opposition to it: because all are invited to come in here before this tribunal, representing the Government, which is the real party in interest. It is for the country to decide through its representatives in Congress whether this petition will be granted, which proposes to aid in a great work, which we claim will be important in developing these great interests of the country. Now, I am perfectly willing to go on here for half an hour in the opening of this case. I would not go on longer, because I prefer that Mr. Sutro, as he is so much more competent, and understands this matter so much better than I, should have all the time he desires in the argument. If that should be determined, why then what little time I may need I will take up, and then Mr. Sunderland can submit his argument; and after that, at the next evening, Mr. Sutro can make his closing argument.

The CHAIRMAN. My understanding of the order we agreed upon at the last meeting of the committee is, that as Mr. Sutro, or the gentleman who represented him, held the affirmative of the proposition here, he should properly open and state the reasons on which he based this application for aid, to be followed by Mr. Sunderland, each gentleman or either side to be allowed three hours. (To General NEGLEY.) Is that your understanding?

General NEGLEY. Yes, sir.

Mr. SHOBER. That is the practice in our country.

Mr. RICE. I am aware that is the practice.

Mr. SUTRO. Two evenings will be divided up in that way.

The CHAIRMAN. Certainly.

Mr. SUNDERLAND. On the division of time, Mr. Chairman, I suppose that, under the order of the committee, neither party can claim of one evening more than an hour and a half.

The CHAIRMAN. I do not know. If Mr. Rice occupies an hour this evening and you two or three hours, he would be entitled to two hours the next evening.

Mr. SUNDERLAND. But suppose I do not desire to make any argument this evening, but limit myself to one hour on Wednesday evening: I want to know whether I will be permitted to do that.

The CHAIRMAN. That may involve the holding of another session.

Mr. SUNDERLAND. Not at all.

Mr. SHOBER. Mr. Sunderland means, if he does not see proper to reply this evening, or commences his argument this evening, that he will only take an hour on Wednesday evening. Suppose Mr. Rice occupies an hour and a half this evening, he will be entitled to the hour and a half of his time on Wednesday evening; or if he occupies a half an hour this evening, he will be entitled to two hours and a half on Wednesday evening.

Mr. RICE. That will necessitate rather a long session.

Mr. YOUNG. I understood each side was to have three hours if they desired, and that we were to have two sessions.

The CHAIRMAN. Yes, sir; but nothing was said——

Mr. SUTRO. If you take a portion of the second evening, there would not be three hours left. If Mr. Rice takes half an hour to-night——

The CHAIRMAN. It will involve a long session. That will be all.

Mr. SUNDERLAND. I think I could make an argument more satisfactory to myself, and if it makes any impression at all upon the committee it would be better calculated to make that impression by my submitting all I have to say in one evening, instead of spinning it out into two or three. It would certainly be more satisfactory to me to be allowed to submit what few remarks I intend to make at one session of the committee.

Mr. YOUNG. I presume the action of the committee led Mr. Sunderland to suppose that he would have his time

on the second evening, the first three hours being taken up by the affirmative.

Mr. SHOBER. No, that was not the understanding. The understanding was that each side was to have three hours.

Mr. SUNDERLAND. That is very true; but when it was determined by the committee that Mr. Sutro should open, I supposed there would be a real opening of the case, and not have the argument reserved for the reply—the final argument. I believe that is not very customary.

Mr. SHOBER. They propose to open the case to-night. That was the understanding just now. The question was, whether you would reply to-night, or commence your reply Wednesday night.

Mr. KENDALL. Mr. Chairman, would it be too long a session on Wednesday night to sit, say three hours or three hours and a half? It seems to me that would not be too long.

Mr. SHOBER. We have been in the habit of sitting that long in taking the testimony.

Mr. SUNDERLAND. I shall try not to weary the committee by consumption of time, and I am willing to limit myself to an hour.

The CHAIRMAN. Then we can close the hearing next Wednesday evening, probably.

Mr. RICE. Mr. Chairman and gentlemen, inasmuch as this motion has been put in, I will submit my answer to-night.

Mr. SUNDERLAND. Do you understand this other motion to be made also, that you may speak upon it as well, or shall I make it now in form?

Mr. RICE. Put in the motion now.

Mr. SUNDERLAND. I will write them out and submit them to you.

Mr. RICE. It is in regard to what?

Mr. SUNDERLAND. This matter of General Foster.

Mr. Chairman, I proposed to prove by General Foster, at his last examination, that the Sutro Tunnel Company was a corporation organized in San Francisco, in the State

of California, with a capital stock of \$12,000,000, of full paid or unassessable stock. That up to the 19th day of August last there had been issued by the company over \$7,000,000 out of \$12,000,000. At that time there was in the company only \$31,000. The balance of the stock, which was less than \$5,000,000, had been set apart by the company for the construction of the tunnel, which is made an exhibit to the commissioners' report, and that on the first day of July last there had been expended only \$42,800, making the cash proceeds, so far as any body knows, of this \$7,000,000 of stock, \$73,800. That proof was not received by the sub-committee. The object of the proof was to show the character of the Sutro Tunnel Company, the objects of the incorporators and manipulators of that corporation; to show that it is, in fact, a stock-jobbing operation from the beginning to the end, and that there is no substantial interest in it; that after all the franchises granted by the Government to Sutro and his associates, and after all the talk of work that has been done upon that tunnel for the last number of years, up to July last there have been spent only \$42,800; and that this \$7,000,000 of stock that has been issued, and which the committee will please remember was unassessable and full paid and put into the hands of parties who are interested in the origin of this scheme, is either in their hands for speculative purposes, to be enriched by this appropriation of three millions by Congress, or it is in their hands for the still worse purpose of manufacturing public opinion in favor of this appropriation.

Now, I think it very important to have that testimony in, because, if these men originating this tunnel project are not spending their own money—if they do not intend to spend their own money; if it is only for speculative purposes—the company cannot commend itself to the Government and to Congress as a proper object of the receipt of this appropriation. If they have confidence in the success of the tunnel as a business enterprise—and it is a private enterprise, and it cannot properly be called anything

else than a private enterprise—why do not they put their own money in; why don't they run the tunnel; why is it that they ask Congress to give them \$3,000,000 to enable them to send their stock up to par, and realize these \$7,000,000 that they have in their pockets to-day. It seems to me that that testimony ought to have been admitted, and it is very pertinent, when this same corporation is applying for Government assistance.

MR. RICE'S ARGUMENT,

APRIL 15, 1872.

MR. CHAIRMAN AND GENTLEMEN: I will submit a few remarks first in reply to the motions put in by Mr. Sunderland. In the first place, we say the introduction of the testimony which has been printed has already been passed upon by a competent tribunal, the sub-committee that was appointed to take this testimony; and were it not so, then we have to say that there is no rule binding this committee, acting as they are for the Government, coming here independent of both sides of this case, as represented by counsel here, and sitting here to adjudicate upon a matter of deep interest to the Government. They are not bound by any specific rules, and there are no rules binding any committee. They each make their own rules. Sometimes, in the Committee on the Judiciary, they are quite formal, and will hold counsel up to strict rules of evidence, but in no other committee that I have ever known of—and I happened to be, while I was a member of the House of Representatives, on two investigating committees, and took and heard evidence in other committees—were the strict technical rules of judicial procedure asserted or relied upon. The committee always opened the doors just as widely as they saw fit to. Now, in regard to the question of admission of testimony: In the first place—and it will be rather stale and uninteresting to these gentlemen of the sub-committee, because we have gone over all this, Mr. Chairman—this is no new question to these gentlemen, because it was argued fully and at length when the evidence was offered, and the sub-committee decided it should be admitted. What I was going on to say, or repeat, rather, what was said before the sub-committee, was, that this testimony was put in to rebut certain statements that were reported by the commissioners who were appointed

by the President to examine this subject, and what they termed as official statements of these gentlemen; and its bearing was upon a very important branch of this subject and of these mining operations. That was and is, whether it would be a saving on the whole, on the operations of mining, to have this tunnel completed and used for the purpose of taking out ore, and especially for drainage; whether the statements which the superintendents of these mines have made to these gentlemen, and upon which they based the figures and statements which they have made and submitted—whether that basis had a true and correct foundation in fact? And the only way for us to meet that was to get from the very best source we could find—the books of one of these mining companies—the fact of the daily operations by which the water was, day after day, taken from these mines; and showing what we claimed from the beginning, and what these mine owners conceded in the beginning, that the water which was in the mines was the great difficulty in the way of the effective and profitable mining of the Comstock lode. And I do not wonder that Mr. Sunderland comes here and objects to the introduction of this fact, because it does contradict this Mr. H. H. Day, out of his own mouth, by his own daily letters, and by his own daily acts. It convicts him of most outrageous perversion of facts: for in his report, which is in the appendix to the commissioners' report, he speaks of that country as a dry country; represents that the proposed tunnel will be valueless for purposes of drainage. When you come to read the facts under his own hand, as written from day to day, before this question was pending; when there was no earthly object for him to misstate or misrepresent the facts, you will find that the very work which he reported upon was constantly flooded with water, and that to keep the mine free from water was the prolific cause of cost, delay, and ruin. This, I say, does damn the testimony of this Mr. Day; and, in destroying his testimony, we claim that it invalidates the testimony of all these other interested witnesses.

Now, why did we get at these facts? Because, at last, these gentlemen, who have controlled these mines, have fallen out among themselves. People do fall out sometimes. I am not going to say that these are a particular class of gentlemen who fall out, and hope that honest men may get their dues; but they have fallen out, and this Ophir mine happens to have fallen into other hands—into hands where they were perfectly willing to give us all the facts which their books show, and which these commissioners were not able to get out there; or, if they were able to get them, it is a fact that they state that they did not get them; but simply let these interested gentlemen, who are making their thousands and tens of thousands of dollars out of these mining operations, and out of the speculations growing out of them—let them sit down secretly in their offices and make out these statements, upon which they base their report, which we show by these entries, to a very great extent, are erroneous.

Now, I say again that, this whole matter having been passed upon, I am somewhat surprised that it should have been reopened; and I can only account for it from the fact that these facts, which we put in here, are so damaging to the position assumed by these gentlemen, who have now seen fit to oppose this grant for the purposes of this great work.

Now, so far as the other question is concerned, there was a proposition made, or an offer made by General Foster during this examination, to put in certain facts obtained, as he said, from the books of the Sutro Tunnel Company. That was not passed to any one of the committee. I proposed to take it, and the paper was immediately withdrawn from my hands. I believe it is a rule of practice that the opposite party shall always have the right to inspect a paper before it goes into a case. We had not that opportunity, and the committee having determined that new matter should not go into the case, and especially from General Foster, who had been here night after night as a Government witness, and whose testimony had been fully

closed after a lengthy and thorough cross-examination by the counsel, the committee very properly arrived at the conclusion that they would not receive any new matter from General Foster, and upon that conclusion this piece of testimony was ruled out, although the committee will bear me out in saying that we withdrew all objection, and gave our free permission that the paper might go in; and we have desired it should be put in, for we have nothing to conceal in this whole matter. We want nothing but the truth, the whole truth, and that we have sought from the beginning. I will dismiss, with these few remarks, this part of the subject.

And now, gentlemen, we appear before you here, as has been said, in support of a bill that is before your committee, by which it is asked that the Government may aid the Sutro Tunnel Company in the completion of their work. It is a well-guarded bill, or, if it is not, it is for you to amend as you see fit, if you decide that this aid should be granted.

Mr. Sutro some years ago went upon this famous Comstock lode. All men of scientific attainments like him, all practical miners like him, all men of a speculative turn perhaps—and he may have been one of that kind—went to that famous lode, hoping to make money undoubtedly, and there, having understood somewhat, or quite largely, the proper methods of mining, he at once discovered, from what he had seen and read in the old countries, that the mining operations there were not of the most economical and the most effective character. And therefore he proposed—he started the idea of taking up that which was done in all the old mining countries—reaching the depths of this lode down two thousand feet or more, below the outcroppings on the mountain side, so that the prospecting and the mining might be carried on with more efficiency and with less expense. The proposition was met most heartily by those gentlemen owning the mines. And, in furtherance of the scheme, Mr. Sutro obtained an act of incorporation from the Legislature of the State of Nevada, by an act approved 4th February, 1865, incorpor-

ating this Sutro Tunnel Company. And, then, when he opened his plan to the principal mine owners on the lode, they, feeling and knowing the necessity for such an operation, for such an auxiliary to their mining operations, knowing the vast expense they were at daily in freeing their mines from water, entered into contracts, which will be found in this book of Mr. Sutro's, called "The Sutro Tunnel," and which you will be familiar with, because you will read it—I shall not have time to read these contracts—by which they conceded certain things, and agreed to do certain things, on condition that this adit or tunnel should be completed. Among other things, they agreed to pay him for all ores taken out \$2 per ton, and other sums for transportation of ores, timber, men, &c. This was entered into in good faith at the time undoubtedly, but for some reason or other, very soon after, these gentlemen changed their minds in regard to it. Our theory of that action is, that they saw that there was money in this, as Mr. Sutro saw there was money in it—money for himself and money for the mine owners. But these gentlemen who had made their money and were making money from these mines, which were the property of the Government and not their property, except as they took them up as squatters, having no interest in them, having no right in them any more than any other citizen, except as a squatter right, they entered into these contracts of mutual advantage to both parties; and, as I said, our theory of the sudden conversion that came over these men is, that they were, notwithstanding they were making fortunes out of the mines, which were successfully opened—they felt they could take that which Mr. Sutro had discovered—the proper method of reaching these mines by this tunnel, and, by wearing him out, they could build it themselves. That, I think, the case will show was the real reason why they changed their tactics, and why they have been making war upon him from that time to this.

When they started him on, and bade him God speed in the accomplishment of certain things, they felt the neces-

sity of this great work. They thought him competent to attend to it, and they believed that was the best way to do it. But as soon as he moved in it, and they began to see the advantages of it, and what might be the advantages to him, they, with an avarice, not perhaps peculiar to them, but very common in the world, sought to oust him of the benefits of what he had done, to deprive him of his rights, and make them subservient to their own interests.

Well, then, in following this case along, we find that Mr. Sutro came to Congress and obtained the act of Congress, approved July 25, 1866, and under that act the rights under these contracts were confirmed to him by Congress; and here let me again say, that at this time these squatters had no earthly interest in these mines, say what they got under local mining laws. They were absolutely the property of the United States, and the Government of the United States had full right of authority to do just what it pleased with them. And when this case was presented, and the Congress of the United States saw and were convinced that this tunnel would be of such an immense advantage, and that the whole State of Nevada, and all these mine owners, and all the operative miners were asking for it, believing it to be the great instrumentality by which that vast money chest of the nation was to be thrown open, and its rich treasures thrown out broadcast over the world, to enrich it, and to change the values of property and all that sort of thing—I say they came here, and Congress did not hesitate to bestow these privileges upon Mr. Sutro, which are contained in this act.

The 1st section of this act provided:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of the construction of a deep draining and exploring tunnel to and beyond the Comstock lode, so called, in the State of Nevada, the right of way is hereby granted to A. Sutro, his heirs and assigns, to run, construct, and excavate a mining, draining, and exploring tunnel; also to sink mining, working, or air shafts along the line or course of said tunnel, and connecting with the same at any points which may hereafter be selected by the grantee herein, his heirs or assigns."

Then it states what the size of the tunnel shall be.

Section 2, provides:

"SEC. 2. *And be it further enacted*, That the right is hereby granted to A. Sutro, his heirs and assigns, to purchase, at one dollar and twenty-five cents per acre, a sufficient amount of public land near the mouth of said tunnel for the use of the same, not exceeding two sections, and such land shall not be mineral land or in the *bona fide* possession of other persons who claim under any law of Congress at the time of the passage of this act; that upon filing a plat of said land the Secretary of the Interior shall withdraw the same from sale, and upon payment for the same a patent shall issue."

All that has been performed. All the conditions have been performed on the part of Mr. Sutro, and this tract of land passed to the Sutro Tunnel Company; and that is very important, because, lying at the mouth of this tunnel, and between there and Carson river, is a beautiful plateau, well fitted for the important purposes of reduction and concentration of ores, and all the other important operations consequent upon opening of the tunnel.

Section 2 further provides:

"And the said A. Sutro, his heirs and assigns, are hereby granted the right to purchase, at five dollars per acre, such mineral veins and lodes, within two thousand feet, on each side of said tunnel, as shall be cut, discovered, or developed, by running and constructing the same, through its entire extent, with all the dips, spurs, and angles of said lodes, subject, however, to the provisions of this act, and to such legislation as Congress may hereafter provide: *Provided*, That the Comstock lode, with its dips, spurs, and angles, is excepted from this grant; and all other lodes, with their dips, spurs, and angles, located within the said two thousand feet, and which are, or may be, at the passage of this act, in the actual *bona fide* possession of other persons, are hereby excepted from such grant."

By this *proviso* it will be observed, that the Comstock lode, and all other lodes, or parts of lodes, in the actual possession of other persons, are excepted from this part of the grant to Mr. Sutro:

"And the lodes herein excepted, other than the Comstock lode, shall be withheld from sale by the United States; and if such lodes shall be abandoned or not worked, possessed, and held in conformity to existing mining rules, or such regulations as have been, or may be, prescribed by the Legislature of Nevada, they shall become subject to such right of purchase by the grantee herein, his heirs or assigns."

Then the third section is still more important in its bearing upon the question before the committee, and to which I more especially desire to direct your attention. It reads as follows:

"SEC. 3. *And be it further enacted*, That all persons, companies, or corporations, owning claims or mines on said Comstock Lode, or any other lode,

drained, benefited, or developed by said tunnel, shall hold their claims subject to the condition which shall be expressed in any grant they may hereafter obtain from the United States; that they shall contribute and pay to the owners of said tunnel the same rate of charges for drainage or other benefits derived from said tunnel or its branches as have been or may hereafter be named in agreements between such owners and the companies representing a majority of the estimated value of said Comstock lode at the time of the passage of this act."

The important provision in that section is, that all patents which should thereafter issue to any of these claimants of the mines—persons who obtain these possessory rights—that in such patents should be inserted this provision, making the grant subject to these contracts. That is very important to the Government, provided this aid is granted; because it will insure a revenue which will amply secure the Government for the advances it will make. This act, you will observe, was approved July 25, 1866, and it will be found in the Statutes at Large, vol. 14, page 242.

Then the next step in this proceeding was in the 40th Congress. A bill was introduced and referred to the Committee on Mines and Mining, of which Mr. Higby, of California, was then chairman, which asked \$5,000,000 for the purpose of making this great work. That was fully considered by the committee, and this very able report was made, and signed by Delos R. Ashley, Morton C. Hunter, James M. Ashley, Orange Ferris, John F. Driggs, Rufus Malory. (See House Report No. 50, 2d Sess. 40th Congress.)

That bill was reported, as I understand, unanimously, or rather no member of the committee submitted a minority report. The concluding paragraph of the report is in these words:

"If we take into consideration the magnitude of this undertaking, the large yield of bullion which will be directly secured thereby, the great influence by its successful completion upon all our mining districts, the stimulus it will give to mining generally, the positive proof it will furnish of our immense mineral wealth, and consider the importance of attaining these results, in view of our large national debt, ordinary wisdom and foresight should command that the aid asked for the construction of this important work, or a much larger sum if it were necessary, should be granted, even were no security whatever offered for its repayment."

Action upon the bill was prevented by the intervention

of the impeachment of the President of the United States. I believe that was the only reason it was not acted upon at that session. It could not be reached. It was impossible to reach any bill, because everything was suspended until that matter of impeachment was finally disposed of.

The CHAIRMAN. What was proposed in that bill?

Mr. RICE. That bill proposed to give \$5,000,000.

Mr. YOUNG. Absolutely?

Mr. SUTRO. No, sir; as a loan.

Mr. RICE. Precisely, as in this bill. I thought I had the bill here, but I find I have not.

After this bill was reported, then the tactics of these gentlemen, who had become suddenly the opponents of this measure, took a new turn. In the Forty-first Congress they appeared here and introduced a bill which proposed substantially to repeal the third section of this act, as I have stated to you. And over that was a long contest and a long hearing before the Committee on Mines and Mining.

And after a full hearing of the case upon its merits, in all its branches, in all its ramifications, and with able counsel, coming from San Francisco, to present the arguments for the Bank of California, or the persons owning these mines, or both together—it makes no difference—they came here and demanded of Congress that they should abrogate the rights which Mr. Sutro had obtained by this act of Congress, and relieve them, in fact, from the agreements which they had voluntarily entered into for the completion of this tunnel, and to relieve them from the obligations which they had undertaken in consideration of his performing these acts. After a full hearing, as I said before, the committee asked to be discharged from the further consideration of the bill. Mr. Sargent submitted a minority report, claiming that the construction of the law should not be left in that way, but that they should substantially explain away the provisions of that third section of the act, so that this royalty could not be collected in favor of the Sutro Tunnel Company. The argument was

very able on both sides, and after a full hearing of the case the bill was laid upon the table by a vote of 124 to 42. That was the end of that operation. In that great battle between Mr. Sutro, who appeared single-handed and alone, and the Bank of California, Mr. Sutro's rights were made so patent and so plain, and the importance of this work was so thoroughly demonstrated, that by that most decisive vote, after a most able and lengthy argument, the whole thing was set at rest. And then in this Congress, at the March term, a law was passed to have this commission sent out, to examine this question and report. This all shows the constant care and the constant interest of this Government in this great enterprise. This commission went out there, and they made their report. You have all read it. And from the fact that they based their report somewhat, and to a very large extent, upon the reports of the superintendents of these mines, who are antagonistic to this measure, it was upon our motion that these commissioners were brought in before the committee to explain precisely how and in what manner they obtained the information, and to get more fully and more clearly at their views upon this question. They came before the committee, and the sub-committee has heard them, and their testimony is included in this volume, throwing very great light upon the questions left in doubt, and still more light have we obtained through this examination: and we are very much indebted to Mr. Sunderland for the fact that he insisted upon going beyond what we asked, and beyond what the committee had anticipated, and asked to have other testimony brought in. Two of these superintendents came here voluntarily from the other side of the mountains to give their voluntary testimony in behalf of their employers. They were very gentlemanly and well-appearing men, and I have nothing to say in regard to them, other than this, that they disagreed with all other gentlemen as to the value of this tunnel, as to its practical operation, and as to the value of the mines, and as to what could be accomplished by it and through it; and Mr.

Requa also expressed the opinion, very clearly, that he did not believe that this lode would be found to be ore-bearing very much farther down; in which view even Mr. Sunderland disagreed with him, for he admitted that it was a true fissure vein, extending downwards indefinitely; and I believe everybody else believes the same. He is one of those practical men, who evidently only believes in what he sees, and nothing else. I was about to say that we got most valuable testimony from Mr. Raymond, the accomplished Government Commissioner of Mines and Mining, with whom the sub-committee, who heard him, must have been exceedingly interested, from his clear statements in regard to this whole matter. It was a great pleasure, I have no doubt, to the committee, as it was to me, to listen to a thoroughly scientific mining engineer upon a question of this magnitude and of this very great interest. And hardly less interesting was the testimony of Mr. Luckhardt, who came here at our solicitation, from the other side of the mountains, too. You know very well how he appeared. You know how cautious he was in the opinions he gave. You know what opportunities he had had for understanding this whole thing. And you understood from him what unusual opportunities he had for studying every condition and every circumstance connected with this wonderful Comstock lode. He was there five years in the employ of men who sent him there, as their confidential agent, to report upon all the mines. The superintendent who has charge of a mine, to be sure, can make an accurate and positive report in regard to his own mine; but this gentleman went from one mine to the other, and he had access to them all. The Bank of California sent him wherever he desired to go or they desired him to go in these mines; and, therefore, he studied it with the eye of a scientific as well as a practical engineer, and he knew all about the matter.

Now, we claim, gentlemen, that with these facts, there should not be any question about what the Government should do, and we claim that it will only be doing what it has been doing in every other branch of public interest in

this country. Why, from the very beginning of the Government down to the present time, we have been fostering and sustaining almost every branch of industry, more or less. And especially so where it only requires the credit of the Government to help along in these great enterprises. We claim this as one of that class of enterprises where it requires such a vast outlay of money as to render it beyond the means of private individuals to carry it forward to completion; and, therefore, when it is of that commanding magnitude, like the great Pacific railroads, or like the great question of commerce, or like almost any other of the great questions, where the amount of money to be expended is beyond private means, the Government shall come in to assist in the development and fostering of these great interests. We did it all along in the early days of the Republic, during Democratic administrations and during Whig administrations. We had the great fishing interests of the country sustained by bounties upon fish. There was a great quarrel over it, and at last it was yielded. Our fishermen got to that point where they could sustain themselves, and the fishing bounties were given up, probably very much to the detriment of the country, because we ceased to raise up sailors who are to make our seamen to navigate our ships when brought in deadly conflict with the great powers. It is perfectly analogous to the aid the Government extended to the Pacific railroad. In a very much less degree, to be sure, but still, if there was any justification for these great works, and we claim there was justification for them, and there was necessity for them, and the Government has done itself great credit and great honor, and has thus wonderfully developed the growth of the country, which has astonished the whole world, and has made us to stand aloft among the nations of the earth; I say it is analogous to the aid which has been given to these great enterprises, for this mineral interest of the country is second to none, as Professor Raymond said, unless it be the agricultural interests of the country. And it is for us to unlock this money chest of the nation, as President Grant

said, and take out this wonderful deposit, more wonderful than any in the world; and as these scientific gentlemen testified, this Comstock lode is of more value and richer than any other similar deposit in the world, and we propose to strike into the bowels of the earth 2,000 feet down, and to take out from that mountain its wonderful resources, \$15,000,000 a year—some say \$30,000,000 a year—to be doubled, tripled, and quadrupled, we say, when this tunnel shall be completed. Why, it seems to me, gentleman, that it does not require an argument. It does not require any evidence to show that this tunnel must be of the very greatest benefit in developing these mines, because it is a self-evident fact. It is evident to my friend from Pennsylvania, who knows something about the mining interests of his own State—that wonderful State of Pennsylvania, so rich in her mineral possessions that, if you strike into a vast mine where you can mine upwards and downwards, forming a new base for your operations, you can reach very much greater depths and have very much greater returns and very much less expense than you can by any other means. We claim that this will most thoroughly ventilate these mines, and every body understands the importance of perfect ventilation in these operations—every man who ever went into a mine understands the necessity of it—and nobody can doubt that by these means you will get that ventilation. Nobody doubts, for all concede that the entire amount of expenditures for raising water from the deep mines will be saved by the construction of this tunnel, and every body must know, for it is a self-evident fact, that an immense amount of ores, and an immense amount of *debris* and waste rock can be taken out through this tunnel by a railroad very much cheaper than it can be hoisted up to the top of a mountain. It is a self-evident fact, so palpable, so patent, and so conclusive, that it is almost waste time to argue it for a single moment.

Then, again, gentleman, in regard to this matter, it is conclusively proven, and I think the gentlemen of the

committee, all of them, when they shall go through the testimony, will be fully satisfied that the Government is fully indemnified by this bill for all the expenditure it shall make; because by the bill, it will have a mortgage or lien for their expenditures upon the tunnel, and upon all the franchises of the tunnel company, for its reimbursement for this amount of money; and Professor Newcomb and Professor Raymond and Mr. Luckhardt, these men who understand this question thoroughly, especially the latter two gentleman, say there is no question about the security to the Government. It is only a question of time, Congress simply loaning this money for a very short time to develop this great interest, and to make this a model work for other mining operations with similar surroundings and similar conditions, so that capital may safely invest for the development of these great interests.

Gentlemen, I will not take up your time by arguing or advancing any theories touching the politico-economical bearings of this case. You are, each of you, more competent to do that than I am; but everybody knows what the effect of these vast productions of the precious metals will have upon every interest of the country. It gives a stimulus to industry, and it raises the prices and values of the property; and in connection with our public debt it is of the greatest importance. It is the touchstone by which we are to reach that condition which we all desire as Americans, viz, to be entirely free of debt. It has been our proud boast, in all the years up to the time of the rebellion, that we had a debt so small that it was comparatively nothing; and we want to be different from all the other nations of the earth again, and wipe out this public indebtedness, so that we can say, as we did when our rebellion commenced, that we were comparatively out of debt: so that, in case another war shall come upon us—never another one of an internal character, I trust—I hope the Government will be administered with that justice to all sections, so that that may be avoided in the future; and I also hope that the time will never come when we shall

come in collision with other nations; but, if it does come, you cannot over-estimate the advantage of being free from debt, and being able to go into the markets of the world and get all the money we need, and look back to the past and say that, after this vast war, this vast outlay of public expenditure, and this vast accumulation of debt, in this short time, we have extinguished all our debt through our resources, which have been so vast; and it will be very long before governments will seek to embroil themselves with us, in my judgment.

Gentlemen, I have talked very much longer on this matter than I intended; for I did not design to say anything. What I have said has been said in a very desultory and unsatisfactory manner to myself, and I will therefore call it an opening, and leave the case, so far as I am concerned.

The committee adjourned till Wednesday evening, April 17, 1872, at 7½ o'clock.

MR. SUNDERLAND'S ARGUMENT,

APRIL 17, 1872.

MR. CHAIRMAN: I feel some embarrassments in the argument of the questions before the committee, particularly on the ground that I do not know what I have to answer. What was called an opening of the case on the part of the Sutro Tunnel Company on Monday evening gave me no means of even guessing what the line of argument would be in the case. I shall this evening confine myself rather to making suggestions to the committee, than attempting to draw deductions or to make an argument; and I feel the more induced to pursue this course, because the committee is composed of gentlemen of intelligence, who would most likely prefer to make their own arguments in their own minds, and draw their own deductions from the facts before the committee and from the suggestions made on either side. From the first discovery of the gold in California in 1848 up to the present time, the Government has acquiesced in the claim of discoverers and their successors in interest to the ownership of the mines, while the legal title to the mines has been conceded to be in the Government; yet there

is not a single instance on record where the Government has interfered with the working of gold and silver mines on the public lands, as the parties in possession chose to work them.

Under the laws of the different States and Territories west of the Rocky Mountains, and under the mining rules and regulations in each mining district, and under the decisions of all the courts of the different States and territories where these mines are located, the claims of the miners have been regarded—treated not only as property, but as real estate. Interests in mines are conveyed by deed. The deeds are recorded as deeds of conveyances of real estate. Ejectment suits are brought for the recovery of the possession of mines. Mines are sold under execution. They descend to heirs, and are devised as other property; and if you have the curiosity or the interest to examine the reports of those different States and territories, you will find that the decisions all recognize not only the interest of the occupants of mines, but that that interest is real estate. Therefore, it may be deduced from the non-action on the part of the general Government, and the actions of claimants to mines, and the acknowledgment of those claims by the highest authorities in the different States and territories where the mines are located, that the parties claiming the mines, and being in possession, have had the equity, the title in equity, to those mines, the Government holding the legal title as trustee for the benefit of the parties in possession. I think the policy that has been pursued by the general Government a wise one. It has encouraged the search for mines. A poor man in that country starts out with his little pack on his back, and his shovel, and his pick. He clammers over mountains in search for mines. It is nothing more than a proper reward for his labor and his enterprise—if you please, his recklessness, in abandoning home and comforts—to grant to him, when he finds a mine, the right to work it, and to realize from it whatever may be in the mine. Then follows, gentlemen, after the first discovery, the investment of the mon-

ey of capitalists necessary to develop the mine, because, in a silver mine especially, and in all quartz veins containing either gold or silver, muscle alone will not develop a mine. It requires money. Hence, when the Government has, by its acquiescence in the claims of miners, acknowledged the right of the possessors to work the mines, these capitalists have gone on in good faith, and invested the money necessary to develop the mine. Hence I say, that we were long ago, and long before Mr. Sutro had any claim upon the Comstock, in good faith the owners of that mine. If we were the owners of the Comstock, neither Mr. Sutro nor the Government has any right to interfere, and to dictate to us how we shall work that mine. If it is ours, we have a right to develop it in that mode and manner that we think to our interest. I shall attempt to show before I get through that we are not working the Comstock at present with that degree of ignorance imputed to us by Mr. Sutro. The answer which I anticipate to this proposition of our ownership of the mines is, that certain contracts were entered into by different mining companies, owning different sections of the Comstock, while we were in possession. Here would seem to be an acknowledgment by Mr. Sutro that these different mining companies did own the ground claimed by them, and he would therefore seem to be estopped from now asserting that we did not own the mines, when he has contracted with us as owners of these different mines.

But, admitting that all the mines upon the Comstock had entered into this contract with Mr. Sutro, it does not authorize the Government to interfere in a controversy between Sutro and the present owners of those mines. It was a private contract, in which there were covenants on both sides, and the mining companies attempted to secure themselves by requiring certain things to be done by Mr. Sutro. I wish now to read from the contract:

"ARTICLE 1. The parties of the first part" (Sutro and associates) "agree that they will, on or before the first day of August, 1867, commence and with reasonable energy and vigor, and at their own expense, run, excavate, and complete the tunnel and lateral drifts hereinafter mentioned."

"ART. 3. The parties of the first part covenant and agree that the

work shall be commenced at the time specified, by running the tunnel from the foot hills of Carson valley; and also by simultaneously sinking at least three shafts of sufficient capacity on the line of the tunnel, and when the shafts have reached the depth required for the level of the tunnel, then to drift in both directions from the bottom of each shaft, so that there shall be at least seven places of excavation going on from the time that all of the shafts reach the requisite level, all the time until the tunnel is completed, unless connections between some of the shafts are sooner made; and the said work, at all times; shall be prosecuted continuously and without any interruption, except from unavoidable accident, until the completion of the tunnel and of the works which, under this agreement, are to be considered as draining the mine of the party of the second part; and in case of any such interruption occurring, the cause thereof shall be removed or remedied, and the work resumed without delay.

"And the parties of the first part covenant and agree, that on or before the said first day of August, 1867, there shall have been subscribed, in good faith, and by apparently responsible persons, at least the sum of three millions of dollars, for the purpose of carrying on and completing the said tunnel, and the lateral drifts hereinafter mentioned; that of said sum at least ten per cent. shall have been actually paid in cash; that during the first year in which the work shall be prosecuted, commencing on said first day of August, 1867, there shall be expended upon, or on account of the work, not less than the sum of four hundred thousand dollars."

Now, I say that there was at least an attempt on the part of the owners of the mine's upon the Comstock to protect themselves in this contract, by requiring certain things to be done at certain times. First, Mr. Sutro agreed, on his part, to show that he was acting in good faith, to procure from responsible parties a subscription of stock to the extent of three millions of dollars, on or before the first day of August, 1867. He agreed, that within one year thereafter he should expend actually upon the construction of the tunnels and the shafts \$400,000. Therefore, in this contract, time was made an essential part of the contract. Time was of the essence of the contract. Now, there is no pretense here that he had subscription to a single dollar's worth of stock during that time, or that within the year next succeeding that date he expended a dollar upon the work on the tunnel; and when he has failed to comply with that most important part of the contract, under its terms the contract itself had ceased—ceased to be obligatory upon the part of the mining companies which entered into it. Even at this day there is no pretense that there is any subscription to stock.

I have here, and will exhibit, before I get through, to the committee a circular issued by the Sutro Tunnel Com-

pany, which states that the capital stock of the company is \$12,000,000; that it is full paid stock, and consequently there is no subscription to the stock at all, and it is unassessable.

At the time this contract was made there was fear entertained by the different officers of the different mining companies that the water would increase in depth upon the lode, and in consideration of Mr. Sutro's agreement, to do these things within the time limited in the contract, it was agreed to by the officers of the different mining companies who have signed this contract. It may be as well for me to say here that the most of these officers signing this contract, at the annual election next after the signing of the same, were, on account of the signing of that contract, ignominiously turned out of office. The stockholders of these different companies repudiated these contracts whenever they had a right to have their voice heard. On account of the failure of Mr. Sutro to comply with these contracts as to time, the different mining companies upon the Comstock, in order to lessen the cost of supplies, which Mr. Requa says have been reduced 33 per cent. on account of the construction of the Virginia and Truckee railroad, subscribed and paid to that road over \$800,000. Now, if the Sutro tunnel had been commenced and prosecuted as Mr. Sutro agreed to do, there would have been no necessity for the expenditure of this large sum of money by the different mining companies.

By some representation—what it was I do not know—in July, 1866, Congress was induced to pass a law which not only affirmed the contracts, so far as the onerous part of the same on us was concerned, but gave Sutro above what he had asked for, (the franchise, estimated by him to be worth about \$6,000,000 a year,) this royalty of \$2 a ton, and the charges that are specified in the contract of 25 cents per ton per mile for the transportation of ores and timbers, and 25 cents for passing in and out through the tunnel, and without any limitation as to time. We were all asleep. We were not here boring a tunnel through

Congress, or through anybody else. We did not know that Sutro was coming here; but he came here, and got an act passed by Congress and approved by the President, not only to give him all that he claimed under the contracts, but to make all other companies not subscribing to the contract liable to the same payment. I wish now to read the third section of this act of Congress:

"And be it further enacted, That all persons, companies, or corporations, owning claims or mines on said Comstock lode, or any other lode drained, benefited, or developed by said tunnel, shall hold their claims subject to the condition, (which shall be expressed in any grant they may hereafter obtain from the United States,) that they shall contribute and pay to the owners of said tunnel the same rate of charges for drainage or other benefits derived from said tunnel or its branches as have been or may hereafter be named in agreements between such owners and the companies representing a majority of the estimated value of said Comstock lode at the time of the passage of this act."

It is a fact well known, and one that will not be disputed, that there were companies upon the Comstock who persistently refused to enter into this contract. Now, against our will Mr. Sutro came here and got Congress to pass the law, making this contract applicable to the mines which refused to sign his contract, and without any limitation as to when he was to perform the work which he agreed to perform. All we ask, Mr. Chairman, on this question, upon this contract, as to whether it has been forfeited or not by Mr. Sutro, on account of his non-compliance with the terms of the contract, is to be let alone, and let us fight it out between ourselves in the courts, if necessary to be fought out there, and not have any interference, by Congress giving Mr. Sutro three millions to fight us—giving him the advantage of three millions over us to fight this matter out.

I now call the attention of the committee to a fact which they may not at present understand, and to urge that as a reason why Congress should not interfere where the destruction of property by the construction of this work will be so great. Mr. Sutro, in a work issued by him in New York, on the 1st of September, 1866, says—I read from pages 22 and 23 of this pamphlet or circular of Mr. Sutro's—

"The real estate, with improvements, in Virginia City and Gold Hill, exclu-

sive of any mining property, was taxed in 1865 at \$6,882,084. If the mines should cease to be worked, property would become entirely valueless, and since the only means of securing the permanence of the mines is the construction of the proposed tunnel, people owning real estate at these places cannot seriously complain should they be forced to a removal to the mouth of the tunnel.

"The steam mills, which are at present scattered in a circuit of fifteen miles around the mines, and have cost from five to six millions of dollars in their erection, will also have to be removed to the mouth of the tunnel."

There is, first, real estate in Gold Hill and Virginia City of about \$7,000,000; and, second, the cost of the mills, at from \$5,000,000 to \$6,000,000, which would at least be half destroyed by the removal. Since that time there has been this railroad built, which is placed by the testimony of Mr. Requa at about \$3,000,000. Now, the carrying out of this scheme of Mr. Sutro, as the commission report, is the only one which will make the tunnel a success. That is, the erection of a dam upon Carson river, using it as a reservoir, and taking the water for power to a point opposite the mouth of the tunnel, will destroy Gold Hill and Virginia City; will destroy the railroad, as is shown in the testimony of Requa; will destroy every mill upon the Carson river, and all the water power now used upon that river. The loss of property is from \$13,000,000 to \$14,000,000.

Now, I ask if Congress can be induced to pass an act the result of which will be to destroy this entire property, and absolutely bankrupt every man upon the Comstock, whether he owns a shanty worth \$500, or whether he owns the finest building in either the town of Gold Hill or the town of Virginia City?

But of what benefit now, Mr. Chairman and gentlemen of the committee, would this tunnel be if completed? I find that my time is running on so rapidly that I will only be able to refer to pages 6, 7, 8, 9, 10 of the report of the Sutro tunnel commissioners, in which they state that the construction of the tunnel is not a necessity, either for ventilation or drainage. They figure up that the working of the Comstock—that is to say, the mining and transportation of ore—will be \$700,000 more after the completion of the tunnel, transferring ore through the tunnel, than it is

at present. That is the way it is proposed to economize the working of the Comstock ores, with a cost of \$700,000 per annum more than at present.

Then, on page 11 of this report, without reading, I will state that the commission say that by the erection of a dam upon the Carson river the waters of that stream can be utilized at or near the mouth of the tunnel, so as to reduce the ores produced by the Comstock, in their opinion. If that can be done, and then proper concentrating works are erected at the mouth of the tunnel, of which they know nothing; then this tunnel will be a success.

I read now from page 13:

"Whether the Sutro tunnel project fulfills this condition of economy depends, in the opinion of the commission, upon the practicability of securing a sufficient water power from the Carson river, at all seasons, for the reduction of the ores, the possibility of which, though not fully proved by adequate surveys, no doubt is entertained, and upon the efficacy of the method employed in Germany and other countries of Europe for the concentration of ores, of which we are unable to vouch."

Now, gentlemen, I refer you to the report of General Day, which is the only foundation for this project of a dam. General Day says in the report, which seems to have been made after the commissioners left that country, and in answer to the letter, I believe, from Mr. Sutro, that the fall of the river is 255 feet from the Mexican dam to a point opposite the mouth of the tunnel. The point that he selects for the upper end of the reservoir is what is called the Mexican dam—the dam highest up the river. The lowest point is a point in the river opposite the mouth of the Sutro tunnel, and according to the evidence here that entire fall is now utilized, with the exception of two insignificant mill sites, which in all will not amount to 30 feet.

Now, the proposition is to erect a dam at the point which is called the Franklin dam, 155 feet high, to flow the water back to the Mexican dam, covering an area of 1,480 acres. By some strange accident the commissioners say that they would get a fall, according to the report of General Day, of 255 feet—the fall from the Franklin dam, where this proposed dam is to be built, to a point opposite the mouth of the tunnel, being 100 feet. Now, it is very clearly to be

seen that if this is used as a reservoir, the water must be drained from the bottom of that reservoir, and if so, there is only 100 feet fall from the reservoir to the mouth of the tunnel. If it is not used as a reservoir, but simply as a dam, then, according to the testimony of General Foster, which is found on pages 473 to 486 of the testimony, and according to the testimony of Colonel Lalley and that of Messrs. Requa and Batterman, and particularly of General Foster, who went into the figures, it is very clearly shown, (but which I have not now the time to read,) that the evaporation from the surface of 1,480 acres, and the percolation or filtration would be more than double the quantity of water running through the Carson river at the time he (General Foster) was there.

So that, if used for a fall of 255 feet, and not as a reservoir in the dry season of the year, there could not, by any possibility, be a drop of water flowing through the race or flume, and the mills would all stand still.

But then, as the commissioners themselves say, and as each commissioner in his testimony, when I interrogated him, has said—and it will be found in the testimony taken—this whole project of the Sutro tunnel will prove a failure, unless this water power can be utilized in the way they point out, and new machinery, which they pretend to know nothing about, can be found for the concentration of ores—the economical concentration of ores—then the whole project is a failure. In connection with the advantages claimed for this Sutro tunnel, I wish to read from a work here which has been eulogized very highly, I believe, by Mr. Sutro.

Mr. SUTRO. I do not believe I ever did.

Mr. SUNDERLAND. It is the only reliable work that has ever been published on the Comstock lode, because Mr. King spent a number of months upon the Comstock, and he gained all the information that we possessed, and that is what no other living man ever has or ever will do until he spends some time there.

All those men living in Germany and talking about the Comstock—these men who are educated in Germany, in a

country where you cannot bore 200 feet into the ground without having tunnels to relieve you from water—talking about the Comstock, of which they know nothing, is mere nonsense. These tunnels in Germany, and in other mines where tunnels have been run, have been run for drainage, but we live in a different country from that of Europe. We are in a dry country. We are in a country where, by actual experiment, we have proved that in the attainment of depth upon the Comstock we find less and less water all the time, and in two-thirds of the entire Comstock worked to-day the mines are as dry as this floor.

But now I want to refer to what it is claimed here the public and the Government are interested in, to wit: the percentage of the metals saved by the present mode of working.

Now, that to me is rather a strange proposition. If we are the owners of the mines, suppose we have our patent subject to this right of Mr. Sutro, which gives him his royalty and his other charges when he completes the tunnel, still we have our patent, subject only to that condition, and now it is claimed that Government must interfere and assist Mr. Sutro, in order to direct us in another way and another mode of working our mines. Now, has Government ever attempted to interfere with the working of any mine, either silver or gold or an iron mine? Has Government ever interfered in the mode of planting, or the culture of cotton, or rice, tobacco, sugar, corn, wheat, or any of the cereals? It might just as well do it as to interfere with the mode and manner of working the Comstock. There is just the same idea of liberty to direct a man when to plant or when to reap as there is in directing us how we shall work the Comstock.

But I want here to say that nothing would be gained in the percentage saved if the tunnel was constructed. The following tabular statement, taken from the annual reports of the Savage Mining Company for the years ending July 1, 1868, and July 1, 1869, exhibit some of the results of mining operations. These statements are thus commented upon by Mr. King, pp. 241-246:

"The tables show the assay value of the ore, both by the wagon samples and mill samples, the yield of the ore, and the relation of yield to assay value, the proportion of gold and silver, both in the ore and in the bullion, and, finally, the total product in bullion of the quantity treated. The operations of each month are shown in the statements, but the figures of the tables for any single month represent the average result obtained during the month, not from one, but from all mills employed by the company in the reduction of its third-class ore. The second-class ore, treated in the last half of 1867, of which the results are also given, was all worked in one mill. It should be observed concerning the comparatively lower percentage of value obtained from the second-class ore, as shown in the table, that, being richer, it resembles more in character the first-class ore, referred to in commencement of this chapter, in which the precious metals are combined with zinc, lead, copper, antimony, &c., rendering the extraction of the gold and silver more difficult, and unfitting it for profitable treatment by the pan process. In the last year of the two referred to, no second-class ore was distinguished.

"The impression generally existing that only sixty-five per cent. of the value is obtained by pan process, and that thirty-five per cent. is lost, is erroneous; for the return of sixty-five per cent. is based on the result of treating the ore in the pan, and collecting the amalgam in the settler; in some mills the additional product of the agitator is returned with that of the pan and settler, while in other mills this is not done, especially if the required standard of sixty-five per cent. has been already reached by pan and settler without further addition. Moreover, the return of sixty-five per cent. includes nothing of what is, or may be, obtained from the subsequent treatment of slimes and tailings; and, furthermore, it is to be considered that the ore, as charged to the account of the mill, contains an average of six or seven per cent. of moisture, for which, in the return, no allowance is made; the sample for assay, by which the return is made, being previously dried, sixty-five per cent. of the dry sample is really equivalent to sixty-nine or seventy per cent. of the wet rock.

"This may be illustrated by the following data concerning the operations of the Savage mill during six months ending December 31, 1867:

"During that time 5,830 tons were worked. The assay value of this ore was \$318,639 80 per mill samples, and \$324,207 72 per wagon samples; or \$54 55 per ton by mill samples, and \$55 61 per ton by wagon samples. The total yield obtained was \$220,785 17; equal to sixty-nine and two-tenths per cent. by mill samples, and sixty-eight and one-tenth per cent. by wagon samples. This yield was obtained by the ordinary operation of crushing, amalgamating in the pan, and collecting the amalgam in the settler; this much constituting the process to which all ore is submitted in all the mills.

"It will be observed that the required standard of sixty-five per cent. was already exceeded by this alone, without including the product of the tailings, or allowing anything for moisture. During the six months to which these figures relate, the product in bullion from the tailings was \$12,730 71; and if this be added to the yield of the ore originally obtained by the first operation, we have a total product of \$233,015 88, equal to 71.87 per cent., instead of 68 $\frac{1}{10}$ per cent. by wagon samples; or 73.12 per cent. instead of 69 $\frac{2}{10}$ per cent. by mill samples. If, in addition to this, we now allow for seven per cent. of moisture on the ore, not taken into account in the assay sample to which the foregoing percentages are referred, we have an actual return of 77.27 per cent. by wagon samples, and 78.62 per cent. by mill samples.

"Finally, it is to be observed that the product from the tailings above given is not all that is obtained from that source. The amount here stated comes chiefly from the agitator. The stream of tailings passing from the settler, in which the bulk of the amalgam is collected, enters the agitator, where much of the amalgam and quicksilver that has escaped the settler has further opportunity to deposit itself. At intervals of four or five days this vessel is emptied, and the accumulations are reworked in an ordinary pan.

yielding \$18 or \$20 per ton. The yield thus obtained is nearly \$2,000 per month, and forms nearly, if not quite, all the product represented in the foregoing statement. After leaving the agitator the stream passes on, the tailings still carrying enough value to make them worth further treatment; for which purpose they are, in fact, sold by the mill to second parties, who do a profitable business in working them again; but this last product is not included in the figures already given. The yield obtained by this final working of tailings is not definitely known to the writer, but is generally stated at about \$5 50 per ton, which would add about ten per cent. more to the results of the progress in the mill, as already shown.

"Some mills claim to have obtained more than eighty per cent., and even eighty per cent. of the assay value of the ore by the ordinary methods, without including the product of the tailings, or allowing anything for moisture."

Mr. Requa, on page 495 of this testimony, says that 92 per cent. is now saved by the various processes, and that 72 per cent. is returned by the mills to his company, and this is not a matter of conjecture; that during the last year, when that company paid over \$2,000,000 in dividends and took out nearly \$3,500,000 in the aggregate, there was returned by the mills to them 72 per cent. of the assay value of the ores. And then he says that 20 per cent. more is saved in the different manipulations of the slimes and tailings after they leave the mills. Mr. Batterman, on page 569, says that from 90 to 92 per cent. of the assay value is now saved by the present process used.

Now, Prof. Newcomb was very enthusiastic about this tunnel—exceedingly so, as the members of the sub-committee will remember—and he could not stretch his imagination—and he has a very vivid one—up beyond 90 per cent. that might be saved if these concentrating works were erected at the mouth of the tunnel, and sufficient water power procured there to run the works and to concentrate. Now, then, if by the proposed tunnel, and by the erection of works, as proposed, at the mouth of the tunnel, only 90 per cent. can be saved, where have the people, where has the Government, any interest in the running of this tunnel? And that we save now that amount is shown by the different reports: shown by Mr. King; shown by Mr. Requa, who is a mill-man and a miner; and shown by Mr. Batterman, who is the superintendent of the Gould and Curry mine at present, and has been a mill-man, and knows, and does not con-

jecture what percentage is saved. It has been said here at different times that the people upon the Comstock, and especially the institution upon the Pacific coast, called sometimes by Mr. Sutro the California Bank, are great rascals; that they cheat each other every day, and that each man stays awake all night to try and get some advantage of his neighbor the next day; that there is constantly going on what he calls "stock-jobbing;" that when a body of ore is discovered in any mine upon the Comstock, it is covered up until the man who discovers it can buy from his innocent and unsuspecting neighbor all the stock he wants, and then he uncovers it. I have heard of such things. I think Mr. Sutro would play that game if he had a chance; but I do not see how the construction of this tunnel is going to prevent this stock-jobbing.

How it is that a body of ore can be discovered except in the sinking of a shaft, or the running of a drift in any part of the mine, I cannot understand. It would seem from Mr. Sutro's idea that the moment that tunnel goes in, you have only got to put a pair of glasses on your eyes, and you can see everything from one end of the Comstock to the other, and a thousand feet below the level of that tunnel.

Now, how can this thing be any different from what it is now, after the tunnel is constructed? The same drifts must be run; the same shafts sunk; the same winzes must be made to connect the different levels; and there is one or two men that will first find the ore before any one else knows anything about it. Then, if I am right in that, it is not necessary to undertake any defense of the present men who control the Comstock; of the men who have put in the money there to carry on that great work; to demonstrate that it is a fissure vein, without the aid of Mr. Sutro or any of his friends; to bring out \$150,000,000 to be distributed in this country, and assist to keep up the credit of the Government; men who had the nerve, the means, and the capacity, and the intellect to do all these things—I say it is not necessary for me to enter into any defense of these men on account of the attacks of Mr. Sutro: where they are known

they need no defense. And the idea that not only shall the Comstock mine be ventilated, but that the moral influence of Mr. Sutro and his tunnel will put a stop to all this stock-jobbing and stock-jobbing operations, is too ridiculous to be talked about.

Next I say, gentlemen, there is no necessity for this appropriation at the hands of the Government. Mr. Sutro, in this same work, issued by him in 1866, after the passage of this act of Congress, claims that the sale of the land at the mouth of the tunnel, in consequence of the destruction of all this property that I have called attention to, will be worth to him \$3,000,000. I refer to page 31 of this pamphlet. That his income, aside from this, will be, when the tunnel is completed, according to the yield which his imagination has built up, two or three times that of the present, or the yield at that time will be \$6,290,000 per annum. Is not that enough; what more does he want? A man with an income of \$6,000,000 per annum, I should think, had some assurance, if not impudence, to go to Congress and ask assistance—a gift, in reality, which I will show, if I have time, of \$3,000,000, in order that he shall gain a privilege which will bring him an income of over \$6,000,000 per annum. The same thing is reiterated by Mr. Sutro, or rather by the Sutro Tunnel Company. In this circular, issued, I believe, in 1870, the same figures precisely are given.

Now, Mr. Chairman, I find that my time is running away faster than I am. I do not believe, for my part, much in the accuracy of Mr. Sutro's statements, either of facts, or his imagination, or his estimates, and I wish to refer the committee to a few of these inaccuracies. On this same page, and according, I believe, to the estimate of a gentleman whom he has complimented very highly as being a distinguished engineer, the cost of the tunnel will be \$1,983,616, and the revenue during the construction of the tunnel \$500,000, leaving less than a million and a half of dollars actually to be expended in the construction of that tunnel.

Now that is one estimate, reiterated again in 1870 in this

pamphlet. Yet, in the report which was read night before last by Mr. Rice, written, as I take it for granted all these reports in reference to the Sutro tunnel have been written, by Mr. Sutro, and that signed by Mr. Ashley and other members of the committee, the estimate is made \$8,000,000. Then he was applying for \$5,000,000 from Congress. That is the difference in his estimates when he is selling his stock and applying for aid from the Government.

I wish now to call your attention to one other of Mr. Sutro's statements.

I read from page four of this circular by the Sutro Tunnel Company:

"The exact length of the tunnel will be twenty thousand one hundred and seventy-eight feet, over eleven hundred feet of which are already finished—"

When it must have been known to every gentleman of this committee who has listened to the testimony that no part of the tunnel is completed.

"The work being pushed by day and night, it is confidently estimated that the entire tunnel, with the assistance of shafts, can be finished within two years. With its main branches its entire length will be about six miles, and the entire cost from \$2,000,000 to \$3,000,000 less than the estimated income for a single year."

On page 14 of this book of Sutro's upon the Comstock, he says that the present yield of the Comstock is about 600,000 pounds.

"Its present annual yield is about six hundred thousand pounds avoirdupois of gold and silver bullion, worth \$16,000,000, equal to over one quarter of all the gold and silver produced by all the States and Territories on the Pacific coast, or equal to one third of all the silver produced per annum in the world, and exceeding the present total yield of all the silver mines of Mexico."

The silver mines in Mexico, as stated by Mr. Sutro the other evening, were \$29,000,000 a year.

I refer the committee now to a statement made in the Weekly Bulletin of Friday, February 16, 1872, in which the yield of the mines in the State of Nevada are given. They foot up \$22,177,046, of which about one-half were produced by the Comstock, and the other from the different mines in the State of Nevada.

Some weight must be attached to the quantity of silver produced by the Comstock. I will state that it is in evi-

dence in the testimony of Mr. Requa that one-half in value of the bullion produced by the Comstock now is gold.

I wish now to call your attention to one other little inaccuracy, a mistake in imagination made by Mr. Sutro. It is on page 16 of this book. After a great deal of figuring, as he has figured here before the committee from time to time, and before witnesses, and convinced witnesses you know that they were lying, and that he was right, he figures up here, and in this finely bound volume sends it to the world, that the cost of pumping upon the Comstock is \$4,167,720 per annum, without allowing anything for interest on the money invested in machinery, which will amount to several million dollars.

The commissioners estimate the cost of pumping upon the Comstock for the last year at \$124,674. Now, that is a slight difference in opinion between Mr. Sutro and these commissioners.

The bill which is now before Congress, and which ought to be termed "a bill for the relief of Mr. Sutro," it seems to me, has a great many objectionable features. The preamble recites certain things which are in dispute, and the first section of the bill directs the Secretary of the Treasury to set apart as a special fund, to be known as the "mineral land fund," all moneys received by the United States from the sale of mineral lands, to be used in fostering the mining interest as Congress may hereafter direct. The second provides that whenever the Sutro Tunnel Company shall have completed 500 lineal feet in the aggregate of its tunnel and its shafts or branches, the Secretary of the Treasury, upon application to him by said company, shall, from the aforesaid fund, or, if insufficient, from any money not otherwise appropriated, pay to the said company, \$50,000; and in like manner shall pay over to said company a like sum upon the completion by said company of each and every additional 500 feet of said tunnel, shafts, or branches, as hereinafter specified.

There is no estimate here, Mr. Chairman, of the cost of sinking any shaft, and why Mr. Sutro should have \$50,000

for the running of each 500 feet I do not know. It certainly does not cost that. I do not understand exactly how the committee understand the condition of the present tunnel. It is said to be completed, and I think we had some *ex parte* exhibitions here, fine drawings of the tunnel completed; and the newspapers say it is completed 2,800 feet. Now, the then superintendent, Dr. Hazlett, reports, that on the 1st of July, 1871, the company had spent \$42,800 78, and had run the tunnel 2,185 feet.

Now, whether that is the completion of the tunnel or not I do not know. It seems to include all the expenses connected with the starting of the tunnel, putting up of the engine, and in fact starting the work, as you would start machinery upon the top of a mine or a shaft, for the purpose of working a mine, which generally costs more than the sinking of shafts for hundreds of feet or even thousands of feet.

Section 3 authorizes the appointment of a board by the President to examine the tunnel and certify to the completion of the work for each section; and upon that the Secretary is to pay out the money.

Section 4 provides that, for security to the United States of the repayment, by the company, of the sums advanced and the expenses of the commissioners, the payment of such sum shall *ipso facto* constitute a first mortgage lien upon the whole of said tunnel, together with all the engines, buildings, and appurtenances thereunto belonging. Now, that is very kind on the part of Mr. Sutro to offer a mortgage on about one-half what the Government has already given him. They have given him a franchise. They have given him all the mines he may discover between the mouth of the tunnel and the Comstock. They have given him this royalty: they have given him \$3,000,000 worth of real estate at the mouth of the tunnel, which he does not propose to mortgage back. The Government has given him a property which he says is worth over \$6,000,000 a year; and yet, when he asks \$3,000,000 more, he mortgages a moiety of that property, not the whole. How does he propose to

repay this? It is called, I believe, a loan, but he does not agree to pay any interest.

Gentlemen, when capitalists loan money, they require interest to be paid, as well as security for the principal. And when a loan is made upon property, and there is no other security but the property, is it not usual to require all the income from that property to be paid over to the party loaning? But Mr. Sutro does not propose to do anything of the kind. He proposes to expend this \$3,000,000 as disbursing agent and superintendent for the Government, the Government to furnish all the money to run the tunnel until its completion; and after that, under this bill, as he has procured it to be introduced, he proposes to be book-keeper and treasurer for the Government. And then, according to his own accounts, and according to his own returns, without any supervision from anybody, he proposes to give back to the Government one-quarter of the net proceeds of the tunnel.

Now, what interest has he in this work? What interest has he in this tunnel that entitles him to three-quarters of the net proceeds, he himself being the accountant, and the Government, that furnishes more money than he says it will cost to run the tunnel, receiving one-fourth? That is a bargain that any man would like to make. It is one I should like to make myself.

Now, there seems to be a provision here to mislead. First, there is the setting apart of the proceeds of the sale of mineral lands as a special fund out of which to pay for the construction of this tunnel, as if the proceeds of the sales of mineral lands amounted to anything.

I have not inquired at the land office, but I will venture to say from the passage of this act, in July, 1866, to the present time, that there have not been received \$50,000 in all. You pay by the acre, under this act of Congress, for a vein—a lode. It is five feet wide, and how much does it take to make an acre? In this connection I wish to allude to an argument which has been made on the floor of Congress, and doubtless will be made again, that the people of

the whole coast, the whole Pacific coast, the people upon the Comstock, the Legislature of the State of Nevada, the government of the State, and all officials have appealed to Congress to set aside the proceeds of the sales of mineral lands, or to make appropriation for the running of this tunnel.

I hold in my hand, which I will not weary you with reading, a memorial of the Legislature of the State of Nevada, at its last session, to Congress, to set apart the proceeds of the sales of mineral lands for the erection or the assistance to erect large reduction works similar to those in Swansea, so that the different qualities of ores found from Utah to California may be reduced in that country, without sending them to a foreign country, and paying tribute to that country for the reduction of the ores besides the cost of transportation. So that, so far as the Legislature can speak the sentiments of the people, if they ever did authorize or indorse the idea of an appropriation of this kind by Congress, they have since seen their error, and now ask that these funds shall be diverted in a different way.

What specially induced the passage by the legislature of this memorial, was the introduction into the Senate of the United States of a bill appropriating the proceeds of the sale of mineral lands to the construction of the Sutro tunnel. Mr. Sutro has been at work here for seven years. He has been to everybody about this tunnel. There has been and was no opposition to the resolution or memorial passed by the Legislature of the State of Nevada in favor of the Sutro tunnel. There were many people opposed to it. It was introduced in the Legislature there without notice to anybody, and it went through the Legislature before anybody knew it who was opposed to it, as this act of Congress here was passed in July, 1866, before anybody being opposed to it knew anything about it.

I offered to prove, Mr. Chairman, by General Foster, and first to obtain his presence before the committee, I addressed a note to yourself, (Mr. Waldron,) assuming that you would send for him, for the purpose of proving certain facts as to the capital stock of the Sutro Tunnel Company; the

disposition of a part of it, and the condition of the balance. I offered to prove by General Foster, when he was here the last time before the sub-committee, that this capital stock, which the circular here which I have read shows to be \$12,000,000 or 1,200,000 shares, was full paid and unassessable, and that up to the 19th day of August, 1871, there had been issued of that 704,883 shares, leaving a balance on hand of 495,117 shares; and that these shares left on hand were alone set apart by the company for the construction of the tunnel, and that at that date there only remained on hand \$31,000 from shares sold. The report of the superintendent of the Sutro tunnel shows that up to the 1st of July, 1871, only \$42,800 had been spent in the construction of the tunnel. I offered to make this proof to show that the Sutro Tunnel Company is a stock-jobbing company; that it is a paper company; that is a thing in imagination and not reality; that they have not worked in good faith; that they have put none of their own money into the enterprise; and that, though men are now connected with it of immense wealth, they will not put their own money into it.

When I offered to prove it, and it was objected to on the other side, according to all rules of evidence in any court, the facts that I offered to prove are taken for granted, and therefore I take it for granted that this is the fact, because it was objected to on the other side, and we could not get proof. Therefore I go upon the supposition that the facts could not be controverted, and they must stand by them as I offered to prove them. This tunnel project was started seven years ago. It has been under way ever since. These contracts were made six years ago, in which Sutro undertook to do the things I have mentioned: to get so much capital subscribed to his company and to expend so much money within a year thereafter. He did not do it. He would not put in any money. His friends would not put in any money. He went to New York, and they would not put in any money there, because they said, "If this is so good a thing as you represent in this book of yours, go back to California. They must pay so much money, and we

will pay the balance." But, mind you, nobody in California put up any money on this statement; nobody would put it up and intrust it to Sutro's management, however good the project. Then he went to Europe and got all these complimentary letters to himself, came back, but that did not get any money. Then the company was organized in San Francisco, in which, and by the terms of which, the stockholders could not be assessed, because it is full-paid stock. When you have full-paid stock, under the laws of California, you cannot assess it; and these gentlemen who compose the Sutro Tunnel Company, and who have means outside of Sutro tunnel, were unwilling to own stock in the company that could be assessed.

Now, they have expended \$73,000 in this great work that the newspapers have talked so much about; that Sutro has talked so much about; and that certain Members of Congress have talked so much about for years past. Does that look like working in earnest? Does it look like acting in good faith with the people upon the Comstock, if they expect to enforce this contract, or does it look like acting in good faith with Congress, to whom they are now applying for this appropriation or this gift? Will Congress assist a company first with a franchise, and then with a grant of lands and mines, the value of which is a great deal more than the estimated cost of the tunnel, by the further appropriation of more money than Mr. Sutro's estimate of the cost of the tunnel, and then give it to him? If it is so necessary to construct this tunnel for the benefit of the Government and people of this country, that Congress should furnish all the money, let Congress furnish the money and own the tunnel when it is completed. We have heard a great deal of talk here about the benefit to science. Some gentlemen have been very eloquent upon that proposition, and they have instanced the appropriation by Congress for money to go to different parts of the world to notice an eclipse. But the Government furnishing the instruments and paying the expenses of scientific men to make those observations did not pretend to appropriate the eclipse to

the men who made the observations. If they send a man to the north pole with a ship, to discover a northern passage, they do not give the passage to the man who first gets through it; and, whenever an appropriation is made for a scientific purpose, the man who executes that purpose and makes a discovery, or fails, gets his salary. Here is a proposition to give Mr. Sutro \$3,000,000 for his own emolument—to enrich him—and yet it is called an appropriation for the advance of science. The proposition by Mr. Sutro is very clearly indicated by a buncombe speech made by him in Virginia City, the object of which seems to have been to embroil the laboring men against the owners of the Comstock, but which speech has been dignified by the commissioners, as I suppose, without ever having seen it until they had made a request to have it published as a part of the appendix to their report. It is a most demagogical speech, and one that is unworthy of a place in the report of gentlemen of the attainments of the commissioners; and therefore I must conclude that they had never seen it until it was in print in this report. I shall read from page 64 of this speech to show Mr. Sutro's idea of the object and purposes of the construction of this tunnel. You will remember that now he was speaking to a class of men a part of whom he had already induced to take stock in this tunnel of his, and the balance of whom he intended to induce to take stock. He says, on page 64:

"The tunnel, they know full well, is the key of this mountain and these mines, and will and must control and own this whole district."

That is the proposition. The tunnel is to control the Comstock, and the owner of the tunnel is to own the Comstock. Well, now, in the name of all that is right and just and fair, if that be the case, will you recommend an appropriation of \$3,000,000, in order to take away from the present owners of the Comstock and transfer that property to Mr. Sutro? If he has got it by virtue of his contracts that he already possesses; if he has got it by virtue of the legislation which he claims to be in his favor, let him take it, but spend his own money to comply with that legislation.

That mine to-day is selling for nearly \$40,000,000 in the market in San Francisco, and yet Mr. Sutro here says, in his own language, that the construction of this tunnel will control and own the entire Comstock. No wonder he is so persistent in making his application to Congress for this appropriation. Then, he says, on the next page:

"Rouse up, then, fellow-citizens! You have no Andrew Jackson among you to crush out the bank which has taken your liberty, but you have a power within yourselves. I do not mean to incite you to any violence. (I do not mean to have you assert your right by force of threats."

No better language could be used to incite these people to that very thing than to tell them not to do it.

"That would be unwise, unnecessary, and would only recoil upon yourselves; but I do mean to say you can destroy your enemy by simple concert of action. Let all of you join in together to build the Sutro tunnel. That is the way to reach them. They do already tremble lest you will act. They know you will form a great moneyed power, and that you will own the mines. They know it will cement you together."

That is to say, if Mr. Sutro succeeds in running this tunnel, that he and his company and the stockholders in that company will own and control the mines of the Comstock.

MR. SUTRO. You might as well state that quotation fairly. I was alluding at that time to a consolidation of the mines; that the irrational manner in which the mines were being worked could not exist for any length of time; that the construction of that tunnel would consolidate them all, and would eventually result in an ownership of the whole property under a rational——

MR. SUNDERLAND. We object, Mr. Chairman, to receiving any kind of instruction from Mr. Sutro. In the first place, we think we know as much as he does, and because we know that we own the mines. We do not propose to receive any instruction from him either as to the mode or manner of working our mines or dealing in our stocks, and when he comes and says that it will be for our benefit to consolidate the entire mine, he means as a matter of course, to include the tunnel. When he does that and asks to have the control of the Comstock, we spurn and spit upon the proposition.

What did Mr. Sutro ever do to develop the mines of this

country or to add to its wealth? Did he ever sacrifice his fortune or his time upon the Comstock? If so, what did he do? We have never heard anything about that. He has been running all over the world for the last seven years to get a smattering of scientific knowledge by which he can impose upon other people. But he knows no more about the practical working of a mine or the running of a mill than *a boy ten years of age*.

Mr. Chairman, the great question involved in this case is one which I shall only suggest, and that is, whether there is any right or justice on the part of Congress, outside of all questions connected with the advantage that the tunnel may be to the Comstock—whether there is any right, or justice, on the part of Congress in making an appropriation for such an object as the running of this tunnel. It is a private enterprise, and I will venture to say there is no precedent on record anywhere for the granting of subsidy like this. Subsidies have been granted, it is true, for the benefit and encouragement of commerce, both as between the States and between this and foreign countries—such as the building of railroads for the transportation of freight and passengers; for the encouragement of lines of steamers for the transportation of mails, freight, and passengers; the improvement of harbors and rivers; but all for the purpose of facilitating, increasing, and encouraging commerce.

Now, here, it is proposed to make a grant—a gift, in fact—of \$3,000,000 to enable Mr. Sutro himself, or his company, to run a tunnel which he says will own and control the Comstock, when he and his company will be the owners of that. Where is the country to be benefited by that? Will anybody say that the Sutro Tunnel Company would manage things any more honestly, or any more fairly than the present owners? Are they any better men? Do they sustain any better reputation where they live? Can they get more metal out of a ton of ore than is in it? Then I will say again that this idea of consolidating the whole Comstock is one which is exceedingly objectionable. As the Comstock is now worked, it is owned in different sections

by different companies. There is to some extent, in feeling, some antagonism amongst them, but not to the extent of interfering at all with the working of the mines. They buy and sell each other's stock, but you allow this entire mine, from one end to the other, including the tunnel, to be merged in one immense corporation, and you control the destinies, including the politics, of that State. In fact you own every body.

Now, I submit that is not a desirable thing to have done, even though it should add a few thousand dollars more to the circulation of the country. We all know the power of these immense corporations. We all know the great danger that this country is now in. It is from the accumulation of power in the hands of corporations. And yet it is urged here, and urged as a reason why Congress should make this appropriation, that the effect would be to consolidate the entire Comstock into one company. If that is according to the spirit of the age and the wish of Congress, I have nothing more to say.

MR. SUTRO'S ARGUMENT,

APRIL 22, 1872.

MR. CHAIRMAN. Eight years ago I concluded to wind up all the affairs in which I was then engaged, in order to devote myself to the execution of a work which I looked upon and now consider of the highest importance to the country.

At that time I expected that many obstacles would present themselves in the execution of so difficult and extensive an undertaking, but little did I dream that, after eight years of toil, anxiety, and labor, I would find myself before a committee of the Congress of the United States, *still* under the necessity of demonstrating what appeared to me self-evident from the beginning.

Great improvements, as the word implies, often involve the abandonment of the previous less advantageous methods, and hence we almost invariably find more or less hostility from some quarter or the other, but sometimes, also, opposition arrayed against undertakings which promise magnificent results, prompted by greed, avarice, and jealousy.

I have encountered my full share of all these; but, as obstacles after obstacles presented themselves, they only nerved me on to overcome them, and I fully concluded to devote, if necessary, the whole balance of my life to the execution of this *one* work, believing, as I do, that it is one of the most important, if not the most important one now in progress on this continent.

By your permission, Mr. Chairman and gentlemen of the committee, I will now proceed to give a brief history of the Sutro tunnel, as it is called, its advantages in facilitating mining operations, the bearing it has upon the national prosperity, and also throw some light upon the character and motives of the opposition.

HISTORY OF THE TUNNEL.

The year 1859 marked the discovery of the Comstock lode. Up to that time no mines of any importance were known to have existed on the eastern side of the Sierra Nevada mountains, and when news suddenly reached California that silver ore had been found there of fabulous richness and extent, the people became imbued with an immense excitement, and rushed in thousands to the spot. The winter set in with its hindrances, but the rush continued. Spring came, and there was no falling off. People believed, and were justified in the belief, that there in Nevada they had discovered an El Dorado unsurpassed by any; and being interested in mining, and feeling considerable curiosity to see the spot myself, I went over there in March, 1860—as soon as it was practicable to cross the mountains—and began a series of examinations. I had expected to witness an extraordinary deposit, but I must say that I was truly astonished at the magnitude and importance of the discoveries which had been made. At that time only forty tons of ore had been taken from the mines and sent to San Francisco. Their reduction yielded a sum in the gross of \$160,000, or an average of \$4,000 to the ton—the most profitable forty tons probably that have ever been worked from that lode. I examined the topography of the country, and recognized the fact at a glance that nature had so favored the locality that the greatest facilities existed for the construction of a deep adit or tunnel; and as early as the month in which I went there—when I had been there, in fact, but a few days—I wrote a letter to a newspaper published in San Francisco, the *Alta California*, giving some interesting information about the mines. The communication appeared on the 20th of April, 1860, and contains these reflections:

“The working of the mines is done without any system as yet. Most of the companies commence without an eye to future success. Instead of running a tunnel from low down on the hill, and then sinking a shaft to meet it, which at once insures drainage, ventilation, and facilitates the work by going upwards, the claims are mostly entered from above and large openings

made, which require considerable timbering, and exposes the mine to all sorts of difficulties."

I wrote that when I had been there only a week, and when I did not know to my entire satisfaction that there was an extensive vein of ore there. Such explorations as had then been made did not extend to a greater depth than twenty or thirty feet.

At another point in the same article I remarked:

"Smelting furnaces, quartz crushers, and all the machinery required for the successful reduction of the ore, could be erected in the valley, and an inexhaustible supply of wood and timber furnished by floating it down Carson river from points some distance above, where there is an abundance of it."

At this time, it should be borne in mind, not a single road had been constructed in that country. The discovery had barely been made, and the mines had only been opened to a very limited extent. I became interested, more or less, in operations there. In 1861 I erected a mill and reduction works, and took up my residence in the neighborhood of the Comstock.

FRANCHISE BY THE LEGISLATURE.

I watched the current of events, and day after day it became plainer to me that there was absolute necessity for a deep mining tunnel. It was clear to my mind, although the idea was very generally scouted. People thought an undertaking of the nature I planned could never be consummated in Nevada. It would take too long a time, and funds would be insufficient, they said; but in the fall of 1864, when our Legislature met at Carson, I petitioned for a franchise, and a bill was drafted, giving me and my associates the right of way for a tunnel, as far as it lay in the power of the State Legislature to give it. (a) The question of payments to be made to the tunnel company was left an open one, subject to such agreements as we might be able to make with the mines. It was, therefore, a sort of franchise such as would have been given to a toll road, or any similar improvement, and not that much. A few thinking

(a) See book on Sutro Tunnel, page 171.

men in the Legislature were struck at once with the idea, and they investigated the matter, although the majority of them said I must be hopelessly insane to propose anything of the kind, and would waste my time for nothing, for the project could never be carried out—the majority of them, I say, ridiculed it. But they granted the franchise by a unanimous vote, nevertheless, and I proceeded without delay to submit the question to the companies owning and operating the mines. I had made a beginning then. I had some rights with which to start out. I had obtained a franchise. The question had assumed a tangible form.

CONTRACTS WITH THE MINING COMPANIES.

A number of us entered into an association, with Senator Stewart for president, and we submitted our proposition to the mining companies. I demonstrated the advantages of the tunnel, and in February, 1865, I published a pamphlet explaining the whole subject, (a) and towards the latter part of the year, after many months of labor, by dint of perseverance, I succeeded in making certain contracts, which were nearly all completed by February or March, 1866. There was no little difficulty attending my progress.

The mining companies, or the men managing the mines, felt very slight interest in the question, and rather preferred not to bother themselves with listening to me. It was not opposition; it was only indifference. There was no opposition; yet it took me eight months of the hardest work I have done in this whole matter to make the people out there understand the merits of the case. We employed some able lawyers, and so did the mining companies. The latter retained, amongst others, Mr. Crittenden, whose melancholy death at the hands of Mrs. Fair you all remember, and on our side were Judge Hardy and others. The best lawyers of California, in fact, were retained in our respective interests. They deemed the contracts very important, and spent months and months in the prepara-

(a.) See pamphlet, "Necessity of a Deep Tunnel."

tion of agreements, by which the mining companies were to bind themselves to pay the tunnel company \$2 a ton on each and every ton of ore that might be extracted for all time to come. These agreements were executed on parchment, and the care with which they were gotten up will indicate at a glance that they were intended to last a great many years, and probably for a century. (a)

PEOPLE BECOMING INTERESTED IN THE SUBJECT.

After my pamphlet had been thoroughly distributed and discussed, I found almost everybody was becoming anxious to have the tunnel made. They began to comprehend it then. They appreciated the magnificence of the undertaking, and, instead of throwing obstacles in my way, they all joined together to help me, the Bank of California among them. They confessed that they could see no money in it then, but they could see a great many difficulties ahead, and they were willing to second my endeavors with their assistance. The royalty of \$2 a ton was regarded as a mere bagatelle. No one thought of it at all as an adequate compensation for the manifold benefits the tunnel would confer; and the trustees of the mining corporations, who often met at my solicitation, and whose meetings I invariably attended for the purpose of explaining my project, the most of whom had been at first unacquainted with the advantages a deep tunnel would furnish, became firm in their conviction that, even at a royalty of \$6 or \$8 per ton, it would be advantageous to them.

THE BANK OF CALIFORNIA FAVORS THE ENTERPRISE.

The Bank of California seemed particularly anxious to help me. They have since been arrayed against me in the bitterest hostility. They have left no stone unturned which could conduce towards the breaking up of the work; and Wm. C. Ralston, the cashier of the bank, who lives in princely style, in a magnificent dwelling, with sixty horses

(a) See book on Sutro Tunnel, p. 173.

in his stables—a man who was at that time a warm friend of the tunnel, and has since grown rich by manipulating these mines—is now its enemy. I have in my possession a letter written by him at that time, which I have never produced before, for it is a private letter, given me as an introduction to certain parties, which during six years of warfare I have kept inviolate, although there is nothing of a confidential character about it. I may as well use it now. It will serve to show the opinion this Mr. Ralston once entertained of the Sutro tunnel. I will read it:

"THE BANK OF CALIFORNIA.

"D. O. MILLS,
"President.

W. C. RALSTON,
Cashier.

"SAN FRANCISCO, May 4, 1866.

"To the ORIENTAL BANK CORPORATION, London.

"DEAR SIRS: This letter will be presented to you by Mr. A. Sutro, of this city, who visits England with the view of laying before capitalists there a very important enterprise, projected by himself, and known as the 'Sutro tunnel,' in the State of Nevada. This tunnel is designed to cut the great Comstock lode or ledge, upon which our richest silver mines are located, at a depth of two thousand feet from the surface, to drain it of water, render it easily accessible at that point, and thus increase the facilities and diminish the expenses of the progressive development of these mines.

"*Too much cannot be said of the great importance of this work, if practicable upon any remunerative basis. We learn that the scheme has been very carefully examined by scientific men, and that they unhesitatingly pronounce in its favor on all points—practicability, profit, and great public utility.* Mr. Sutro, we presume, is furnished with the necessary documents to make this apparent; and our object in this letter is simply to gain for him, through your kindness, such an introduction as will enable him to present his enterprise to the public fairly and upon its merits.

"Commending Mr. Sutro to your courteous attentions, we remain, dear sirs, yours, very truly,

"W. C. RALSTON,
"Cashier."

That this same Mr. Ralston has since been moving heaven and earth to break up this tunnel enterprise I shall fully explain in the course of my remarks.

LAW PASSED BY CONGRESS.

After I had finished the making of these contracts, I set out for Washington, with the intention of getting certain rights from the General Government which no State government could give me; for the fee to the public domain, (a)

(a) See Testimony, pp. 197, 222, 234.

as far as these mines are concerned, was then entirely, and is to this day to a large extent, in the Government. (a) I was to secure certain immunities at the capital, and then go to Europe, for the purpose of negotiating stock or obtaining the pecuniary loans which would be required to carry out the work. Nothing was said at that time about any direct aid from the Government.

I arrived in Washington about the beginning of June, 1866; and on the 25th of July a law of Congress was approved, (b) granting to me the right of way and other privileges to aid in the construction of an exploring and draining tunnel to the Comstock lode, in the State of Nevada. It gave us the privilege of buying some land at the mouth of the tunnel, which we already owned by location, and the right to take such veins of ores as we might cut in running the tunnel, and which we would have had under the common mining law; confirms the rates made in these contracts of \$2 a ton; and makes the patents of mining companies thereafter obtained subject to the condition that this royalty be paid. (c) It was necessary that we should have some such protection as this in the work, for corporations are liable to disincorporate, with disastrous effect upon the binding force of contracts. I found, by consultation with eminent lawyers, that it was absolutely necessary to have some such rights from the Government; and on presentation in Congress the delegation from California and Nevada agreed with me, and the bill which I desired became a law.

NECESSITY OF A COMPULSORY LAW.

Mr. Sunderland, in summing up the evidence which has been taken here, says that this law places some of the mining companies who did not sign the contract under the same obligations as those who did. He says he was a trustee at the time, and *he* did not sign a contract. That is precisely what we wanted to remedy. There were men

(a) See Test., pp. 190, 222, 223, 373. (b) See Statutes at Large, vol. 14, p. 242.

(c) See Test., pp. 221, 222, 282.

in Nevada who were ambitious to play "dog in the manger." They did not want to do anything. They did not want to build the tunnel; but if it should be built they wanted to have the benefit of it, for if we should run it in it would drain the mines for them without expense. Mr. Sunderland was one of those men who would not sign this contract. They said—

"Oh, Sutro will build it, and when done it will drain our mines as well as others, and we shall get the benefit for nothing."

It was necessary to compel them to make a fair contribution, as I will show by a very familiar example. When a number of property owners on a street want to construct a sewer, and one man stays out and will take no part in the work, you must run the sewer by him or it would be useless, and if you run it by him he derives all the advantages from it for nothing. It would be an annoying and insurmountable difficulty. Hence, we find in all city charters authority for provisions making it compulsory on the inhabitants to pay their proportion towards sewers. It is absolutely necessary that they should contribute to such works. (a) We have practically the same principle and the same thing to contend with in mining; and I say now, that the time will come when Congress will pass a general law, such as they had in Spain and Germany, to compel mining companies to pay in cases of this kind. Tunnels are necessary for mining; (b) and it is a great mistake for the Government to grant to any man an absolute title to a mine. The Government should reserve for itself such privileges as are required in the development of our mining interests, the right to make certain regulations. (c) I do not know but that there is a clause in the present law partly covering this very point. There are such laws in Europe. I simply refer to these facts as significant from the principle embodied. It has been the experience in Mexico, in Spain, in Hungary, and in other countries where mining is prosecuted to a considerable extent, that miners never

(a) See Test., p. 372.

(b) See Test., p. 606.

(c) See Test., p. 602.

agree upon such questions, but that they take out all the ore that they can get any money from, and when the mines are gouged out it is impossible to find any one to make a tunnel.

THE UNDERTAKING PRESENTED AT NEW YORK.

After the act of incorporation passed Congress, I thought this matter stood on a basis that was not susceptible of doubt, and proceeding directly to New York from Washington, I published a little pamphlet, in which I explained the advantages of the tunnel and the probable income that would be derived from it. The people with whom I came in contact at that time (and they were some of the wealthiest and most intelligent of the residents of New York) took a great deal of interest in the tunnel, although somehow they regarded it as a vast undertaking, the accomplishment of which would be very remote. My assertions that the income from operating would amount to several millions per annum made them incredulous, and they argued that if that were true, I could easily raise the money in California. Many of the prominent merchants, bankers, and capitalists of New York, however, united in subscribing to a communication to me in which they promised that, if I would go back to the Pacific coast and raise three or four or five hundred thousand dollars, they would get \$3,000,000 for me in the east. (a) In the fall of 1866, therefore, I returned to California, and submitted the proposition to the mining companies. They were then in a pretty good condition. They were prosperous in business, and I found ready listeners when I demonstrated the importance of the tunnel to mining operations. I proposed to them to become interested in the tunnel. I showed them that they could come in at such a rate that it would be highly advantageous to them, for although they would be independent as mining concerns, they would still be owners in the tunnel enterprise, and it would re-

(a) See Commissioners' Report, p. 53.

turn them, by way of profit, all they would have to pay to it in royalty for the ores removed when in bonanza; while, on the other hand, when out of ore, without contributing a single dollar, the dividends from the tunnel would furnish them the means for prospecting. And they saw it, and recognized the fact. They began to subscribe, and in May, 1867, I think, I had \$600,000 subscribed. A great many private people put down their names for \$5,000, or \$10,000, or \$20,000 each, and I had a fair prospect of raising \$1,000,000 in San Francisco, and the whole amount required, perhaps, in California.

OPPOSITION BY THE BANK OF CALIFORNIA COMMENCED. (a)

Then it was that the Bank of California stepped in and concluded to break up the tunnel enterprise. But previous to that time I had again visited the Nevada Legislature, in February, 1867, I think, and asked the members to memorialize Congress. (b) I told them that this was an important question, not only to the State of Nevada, but to the whole country; and they responded to my wishes, urging Congress in the strongest terms to aid this work. They gave their reasons. (c) They showed the politico-economical demands for it. They demonstrated what influence it would have on the payment of the national debt. I should very much like to quote from the memorial, but it would take me too long.

When the California bank people observed the action the Legislature of Nevada had taken, with the conclusive logic of their address, they began to understand the probability that the Government would take some steps to assist in the construction of the tunnel. The Bank of California now came to the conclusion that it was a great enterprise, and, thinking we were about to get a subsidy from the United States, they set out to break it up. The Bank of California rules and runs that country. They owned al-

(a) See Test., pp. 17, 18, 166, 355, 356. (b) See book on Sutro Tunnel, p. xiii.

(c) See book on Sutro Tunnel, p. 77.

most everybody in it, and anybody that refuses to bend the knee to them they drive away. So they concluded to drive me away; and, in their unscrupulous manner of doing things, they began by making the mining companies repudiate their subscriptions. That was the first step they took. I had worked at this undertaking then for several years. I had induced some of my friends to invest some money in it: my means were limited. There were large expenses connected with the enterprise, in the way of making surveys and maps, traveling, arranging contracts, and employing lawyers. The bank, as soon as they had concluded to repudiate, declared that we had not complied with the conditions of our contracts.

THE QUESTION OF CONTRACTS.

That was in June, 1867. The contracts were made in the year 1866, and we agreed in those contracts that we would raise a certain sum of money by the 1st of August, 1867. Now, understand, in May, 1867, three months before our time expired, they commenced their opposition, and said we had not complied with our contracts. I had, however, taken the precaution to receive an extension from the mining companies of another year, and consequently our contracts ran until August 1, 1868.

In order that the circumstances may be thoroughly comprehended, I will refer to a single company, the reports of which I have in my possession. It is the Savage Mining Company, of which Alpheus Bull, Esq., is president—a gentleman who is connected with a great many companies out there, and who is supposed to be a very good man, a first-rate man; a very pious man, in fact; but in my opinion a great scamp, and a mere tool of the Bank of California. This is what he wrote in his official report on July 10, 1866, after the contracts had been made:

"The importance of affording drainage at a great depth, if it can possibly be obtained, cannot be too highly estimated. The Sutro Tunnel Company is the only party that proposes to undertake this important enterprise, and your trustees have entered into a contract with that company, for the purpose of effecting this great object. It is much to be desired that success may attend

the effort, for it is, in my opinion, a work upon which depends the future value and profitable working of the mines of the Comstock lode. I recommend that this contract be ratified by the stockholders at their present meeting." (a)

They did ratify it. That was in 1866. There was no opposition then. Now, let us see what he says—this same man—in 1867; and a very smooth-talking fellow he is, too. Recollect, now, these contracts did not expire till the 1st of August, 1867, with an extension of time made until August 1, 1868. There was an extension from this particular company, the Savage company, which I might as well read right here, now that I am about it, so that it may be put upon the record, and that there may be no question about the extension granted by that company at all:

"Resolved, That the president and secretary be, and are hereby, instructed to enter into the following contract with the Sutro Tunnel Company:

"This agreement, made this seventh day of March, A. D. 1867, between the Savage Mining Company, a corporation duly organized under the laws of the State of California, and having its mine on the Comstock lode, in the State of Nevada, party of the first part, and the Sutro Tunnel Company, party of the second part:

"Witnesseth, That in consideration of one dollar in gold coin of the United States in hand paid to the said party of the first part by the said party of the second part, and of other good and valuable considerations, receipt whereof is hereby acknowledged, said party of the first part agrees and covenants that the said party of the second part shall have, and is hereby granted, an extension of time for one year, from and after the period specified in articles first, third, fourth, and fifth, of a certain contract entered into between the parties hereto, on the thirtieth day of March, A. D. 1866."

[Recollect this gives an extension till the 1st of August, 1868.]

— "And it is hereby declared to be the intention of said grant of extension of time, that the operation and effect thereof shall be the same in all respects as if the 1st day of August, 1868, had been originally inserted in said contract, instead of the first day of August, 1867, wherever the date last mentioned is found therein.

"In testimony whereof the Savage Mining Company has caused these presents to be signed by the president and secretary, and its corporate seal to be hereto affixed, this seventh day of March, A. D. 1867.

"(Signed)

ALPHEUS BULL, Pres't.

"E. B. HOLMES, Sec'y Savage Mining Co."

Now let us see what this man said that same year, on the 18th of July, 1867, before the *original* contract expired:

"On the the 26th of April, 1867, the board of trustees entered into an agreement with the Sutro Tunnel Company to subscribe \$150,000 towards the construction of the proposed drain tunnel, upon two conditions: first, that the tunnel company were to procure *bona fide* subscriptions to the amount

(a) See official report of Savage Company for 1866,

of \$3,000,000; and, second, that the agreement should be submitted to this annual meeting and ratified by the stockholders. *The tunnel company have failed to fulfill the first condition.*"

He said we had failed to fulfill the condition that we were to get \$3,000,000 in *bona fide* subscriptions, and our time had not yet expired. It was before the original contract expired, and a year and over before the extension expired.

Then he goes on to say:

"In addition to this, I consider there are grave reasons for doubting the policy of such an agreement on the part of this company. Suffice to say that I recommend the stockholders to refuse to give their approval to the agreement." (a)

This Bull was the tool of a ring, which had then been formed by the Bank of California, and they thought they could explode the tunnel project. It was next to impossible to obtain redress. You could not do anything in any court of law. It was reported that they could manage almost every judge in that part of the country, and that they had vast influence with all the newspapers. They thought they could ride rough-shod over my rights, but I did not let them do it, nor do I think I ever shall. I hold in my hand the paper, dated April 26, 1867, in which the Savage company agreed to pay \$150,000 to the tunnel company, yet that man had the assurance, three months later, to say we had not complied with the conditions of our contract, when we had a year and over to do it in.

RING RASCALITIES.

They put their heads together then, and said:

"Let us break up the Sutro tunnel. We will get hold of it in a year or two anyhow; and in the meantime we will make the mining companies give the money subscribed to the tunnel company towards a railroad, which we will build and own, and that will kill Sutro, and he will not be able to get the money he wants."

As a result of what I have just stated, in April, 1868, this man Bull wrote in the official report of the company:

"I am so strongly impressed with the importance of the early construction of this railway, and the great benefits it would confer upon this company, that I earnestly recommend to the stockholders the repeal or amendment of

(a) See official report of Savage Company for 1867.

the 4th article of the by-laws, so as to enable the in-coming board of trustees, if in their judgment they deem it advisable, to increase the subsidy of this company to the railway enterprise by an additional sum of fifty thousand dollars.

"With this road constructed and in operation, and with a *deep-drain tunnel which in a few years will be run*, and with a further saving in the reduction of ore, and also to increase the returns of the assay value of them from 65 per cent., the present standard, to 80 or 85 per cent., it is reasonable to believe, with all these advantages secured, we can transmit the danger of profits from silver mining at Virginia and Gold Hill to another generation." (a)

Now, if that record will not damn any set of men, I would like to know what will. There is falsehood proven on them out of their own mouths.

To recapitulate, then, you find that on April 3, 1866, this man Bull, as president of the Savage company, makes a contract with the Sutro Tunnel Company, and recommends its confirmation at the annual stockholders' meeting in July of that year, which was duly made.

On the 7th of March, 1867, following, he extends the time for the fulfillment of that contract until August 1, 1868. On the 26th of April, of that same year, (1867,) the board of trustees of the Savage company, through him, (Bull, their president,) subscribed \$150,000 to the Sutro Tunnel Company; and on the 18th of July, of that same year, he repudiates it all.

The California Bank ring saw the tunnel was going ahead, and while they wanted to break it up, they at the same time wanted to appropriate the money subscribed by the mining companies to themselves; and, in order to accomplish that, they got up this railroad enterprise.

Thus we find this same man Bull, in his next annual report in 1868, recommending the subscription of this identical sum of \$150,000 to the railroad company, which he had repudiated the year before, as far as the tunnel company was concerned; and so confident was he that the tunnel project was killed for good, that he lets out their plans for the future, by saying that *a deep tunnel would be constructed before long*—of course meaning by the bank ring. He thought it was killed off; his indecent haste was

(a) See official report of Savage Company for 1868.

so great that he called in the undertaker before the child was dead.

THEY WANT TO APPROPRIATE AID FROM THE GOVERNMENT TO THEMSELVES.

They now turned around, and their persecution fairly commenced. They thought the tunnel was a good thing, having read my pamphlets. They had not had brains enough to see it in the beginning; but when they did see it, notwithstanding our rights, obtained from the United States Government, they thought they would break it up: after the Nevada Legislature had shown that the Government of the United States was interested in that enterprise more intimately than in any other in the country, and they concluded to appropriate any aid from the federal Government to themselves. There you have the Bank of California. That is the way they do things out there. They thought in a few years I would be entirely used up, for I had no money to fight these people with, and they had millions, and were making millions out of these mines every year, fleecing the people, as I shall show further on. I charge them with these things, and I am ready to prove them.

THE RING HAS NO MONEY INVESTED IN THE RAILROAD.

What does Mr. Sunderland say in his argument? He says this tunnel ought not to receive any aid from the Government, because it would ruin their railroad. Why, that is no objection. They got the money subscribed to themselves away from us, and with it built that railroad in opposition to the tunnel. They built it several years after I obtained my rights. They designed that it should break up the tunnel. They tried to make people believe that, when the railroad should be made, they could bring wood on it so cheap, that they would be enabled to use it for pumping water out of the mines cheaper than it would run out by itself, and the people had no interest to differ from them. One

of Mr. Sunderland's reasons against the tunnel is, that the railroad cost \$3,000,000. The truth is, it only cost \$1,500,000. According to his own statement, they got from the mining companies----- \$800,000
And a gift from three counties of----- 575,000

Making a total of----- \$1,375,000

So there is not much of their money in it.

The railroad may cost \$3,000,000, if they build it to Reno, which would make it more than double its present length.

Mr. WALDRON. What is its present length?

Mr. SUTRO. Twenty-three miles from Virginia to Carson.

Now, I want to call attention to the fact, that more than one half of that railroad never will be injured at all. There are only ten miles that the tunnel could hurt, and I pretend to say that even that ten miles would not become entirely useless, and that Virginia City will continue to exist to a very considerable extent. He says these mining companies have paid \$800,000 already, and they ought not to pay anything towards this tunnel. So far as I am concerned, I can neither see sense nor philosophy in that argument. He says, also, that if we had complied with our contract there would not have been any necessity for making this railroad. I have shown that these people have *prevented* us from complying with the contracts. Their own statements show it. They are full of discrepancies. They say they wanted us to complete the tunnel, and they threw all sorts of obstacles in our way.

NO RUIN TO ANYTHING.

Mr. Sunderland next says that, if made, the tunnel will ruin Virginia City and Gold Hill. It has been stated here that the property there is worth \$5,000,000 or \$6,000,000; but in any mining town everybody knows that mining will some day cease, particularly if operations continue to be carried on as they are in those mines, and property will be worth but very little. I think the tunnel will injure

Virginia City and Gold Hill some, and I think it will injure ten miles of that railroad, but not much, for they can take up their rails and lay them to the mouth of the tunnel, and I prophesy that a large city will spring into existence there. Five years hence we shall see, perhaps, 50,000 people gathered near its mouth. Where they have two or three thousand miners employed now, they will then have 15,000; and the few thousand who will then remain at Virginia City will find plenty of employment in surface digging, for there will be more or less of mining operations conducted independent of the tunnel. It will take a long time to complete the ramifications from the tunnel—fifty years, I do not doubt. In the course of time we shall have in the argentiferous depths of those hills a hundred miles of tunnel—nay, two hundred. That which we seek to start to-day is the main artery, as it were. We go in four miles, and we will have tunnels branching from us in every direction; we will have a subterranean world, with avenues and rock-paved streets, an interminable traffic of cars, loaded with men, ore, and material. (a) There will be a business in this underground world such as no one can have any conception of. The whole mountain will be explored, and everything connected with mining cheapened; and the objection that Virginia City and Gold Hill will be injured falls to the ground; it amounts to nothing. (b)

Mr. Sunderland has also stated that the mills of the Carson river will be injured. There has been a great deal said here about making a large dam near the mouth of the tunnel; but we do not propose to make that dam. That is a dam proposed by the commissioners. They thought a dam would be a profitable investment, and that may be probably so; but in none of my pamphlets or books have I ever proposed making one. There is no necessity for it at all, as I will show when I reach that subject.

He has told us, furthermore, there will be \$13,000,000 or \$14,000,000 worth of property destroyed; that is to say,

(a) See Test., p. 27. (b) See Test., pp. 185, 186.

in property at Virginia City, the mills on the Carson, and this railroad; but I assert (the mills not being affected at all) that the loss will not exceed \$1,000,000. And they are going to get a benefit from the tunnel of more than \$10,000,000 a year. The yield of those mines will be so immense, that the people there cannot help growing rich from them. But Mr. Sunderland says every one will be bankrupted. The solution of the enigma is, the Bank of California is still bent upon breaking up our project, although we are now in a condition to push our work ahead. We have 300 or 400 men at work there at present, and we are going to construct that tunnel in spite of all their machinations.

RETURN TO NEW YORK.

After I saw the power the Bank had out there, I concluded it would be of no use for me to go on there any longer to try to accomplish anything. I perceived that nearly everybody was shunning me, as long as it was patent that the Bank was against me, and I could not raise a cent. Men of business were all afraid of the institution. Most of them were more or less in want of accommodations, and have business ramifications which leave them at the mercy of a great, unscrupulous moneyed concern, either directly or indirectly, so that they may be broken and ruined any day, and no redress could be had; and when I would relate the facts people would not believe me, and I could get no satisfaction. I therefore concluded to return to New York, where the people had told me, "You go and raise three or four hundred thousand dollars." Upon my arrival I showed the documents, in which the mining companies and others had subscribed \$600,000. I told them why they withdrew, but I could not explain that away; no matter what I might have said, they would not have believed it. I did not know what to do about this matter. I was not going to give it up, because I had said I would carry it out, and I was more determined than ever not to give it up

under any circumstances. I thought to myself, "I have that indorsement from the Nevada Legislature; I will explain it to Congress, and submit it there, and let them know what this Bank of California is; what a set of scamps they are, and how they had acted towards me, in what bad faith; how they had perverted facts, and done everything to break up the enterprise; and I will submit this report of the Nevada Legislature, which, I repeat, is a most conclusive argument for Government aiding this work, and developing the vast mineral resources of the country."

Soon after I arrived at New York, I went in one day to Leese & Waller's, the agents of the Bank of California, though I knew they would be against me, and I found a placard posted up, saying that the Savage company had repudiated the subscription to the tunnel company, and that the same was null and void. I was astonished to find in a banking office in New York a placard like that. Everybody from the Pacific coast would come in and read it, and would think I had committed some crime, or been guilty of some rascality. I saw what they were up to. They wanted to ruin me in New York, so I could get no money there. (a)

TRIP TO EUROPE.

I concluded to go to Europe and try to raise some funds there, and at the same time post myself on mining. I was familiar with the great works on mining written by the scientific men in Europe, who had spent a lifetime in studying what had been experienced by others during centuries, and some of whom had traveled all over the world to get experience themselves, and I wanted to come in contact with those people and consult with them. I also wanted to visit the mines there myself, and study the continuance of mineral lodes in depth. I met such men as Von Beust, (b) Sir Roderick Murchison, (c) Von Cotta, (d)

(a) See Commissioners' Report, p. 55.

(c) See Test., p. 614.

(b) See Test., pp. 607, 608.

(d) See Test., pp. 608, 609, 610.

Weissbach, (a) Kerl, (b) Rivot, (c) Chevalier, and many others, the great scientific celebrities of the world. Their books are used in many schools and universities. They all indorsed this project. Some of their letters are published in my book, (d) in which they compliment me on this magnificent undertaking: the greatest undertaking, they thought, going on in America. They indorsed it heartily, these men, thoroughly familiar with mining science. Baron Richthofen, a celebrated geologist, had some time previous written a treatise about the geology of the Comstock lode, (e) and in regard to this tunnel, which he recommended highly. They saw the benefits of the tunnel at a glance. They understood its whole effect. They knew by their own experiences what it would be.

CAPITALISTS ALARMED.

While I was in Europe I made some inquiries as to what I could do in the way of raising money there. I had a great many letters of introduction. I have read one from Mr. Ralston, which I never used. I had letters of introduction from many of the bankers and prominent people in California to leading people in London, Paris, Frankfort, Amsterdam, and Berlin. They thought the tunnel was a magnificent work; but a work of that kind is difficult to carry out, and still more difficult to raise money for. When a capitalist lends money, he wants to have the returns in hand before he lets it go. You know how difficult it is to do anything with such people; but the great obstacle in 1867, about the time the Exposition was going on in Paris, was a feeling all over Europe, in diplomatic and financial circles, that there was going to be a war between Prussia and France. Everybody knew it was coming, and the bourse, which is the most sensitive barometer there is in the world, as far as money is concerned, felt it; and everybody in London told me that nothing could be done with American enterprises, either railroads or tun-

(a) See Test., p. 614.

(c) See Test., p. 613.

(b) See Test., p. 613.

(d) See book on Sutro Tunnel, pp. 33-74.

(e) See book on Sutro Tunnel, p. 95.

nels, or anything else, because war was bound to come. It did not come for two years afterwards, but it did come. At that time, however, it made the impression I am picturing. There was a perfect plethora of money in England. It was lending at one per cent. a year. "If that is so," said I to them, "you ought to be glad to make a good investment." "No," they replied, "the reason money is so low is because people are afraid to invest it in anything." They would rather let it lay in the banks. But when there is confidence they are ready to invest, and it comes up to four and five per cent. a year. That I did not know then, but I am quite sure I know it now.

EFFORTS IN THE FORTIETH CONGRESS.

About the close of 1867 I returned to Washington. I think I left Liverpool on the 1st of December, 1867. I submitted the memorial of the Nevada Legislature to Congress, which was referred to the Committee on Mines and Mining, of which, at that time, Mr. Higby of California was chairman; the other members were Judge Woodward of Pennsylvania, Mr. Ashley of Nevada, J. Proctor Knott of Kentucky, M. C. Hunter of Indiana, Judge Ferris of New York, Mr. Mallory of Oregon, General Ashley of Ohio, Mr. Driggs of Michigan. They became deeply interested in this question; they often met twice a week, nearly every member present. They would meet at that same room where the Mining Committee meets now, every Monday or Wednesday, and I would talk to them about mining. I went into all the details of mining; explained it all to them; and they became deeply interested in it, so much so, that they were anxious for me to come before them and talk about everything connected with mining, independently of this tunnel question. I became acquainted with nearly all the members of the House, and I found a great many friends. After this lengthy examination of the subject they made an able report to the House, recommending a loan of

\$5,000,000, with a mortgage to the Government on all the property. (a)

IMPEACHMENT OF PRESIDENT JOHNSON.

Just then, when the committee was about to be called in the House, the impeachment of Andrew Johnson commenced, and that lasted for months. During that time nothing was done by Congress; they kept on with their meetings in the Mining Committee, but nothing was done in the House. I do truly believe, from my acquaintance with the opinions of members of that House, that that bill would have passed with a three-quarters or five-sixths vote could it only have been reached. There was Thad. Stevens: the old man felt a great interest in this question of getting down deeper into the bowels of the earth than had ever been reached before in the world. I explained it to the old man when he was sick, and sat by him many times when he was in bed. He would have my book with him in bed, and kept reading it. He said it was a magnificent project. I explained to him that during thousands of years man had never penetrated to a greater depth than 2,700 feet, and that we should go down a mile, and see what was there. Well, Thaddeus Stevens was ready to do anything for it; but Congress adjourned, and the old man died, and I went home again, after exhausting all my powers, almost despairing, and being under large expense, and that Bank of California quietly and secretly fighting me, being in telegraphic communication with their agents at Washington all the time. (b) Many members of Congress promised that next winter they would certainly act in this matter. But I had accomplished nothing, and returned to California again. I remained a few months on that side, and then came back to Washington during the

SESSION OF 1868-'69.

I remained here that winter. Grant had just been

(a) See H. R. No. 50, 2d Session 40th Congress.

(b) See Commissioners' Report, p. 56.

elected President, and you know, gentlemen, that at that session there was no disposition to undertake any legislation. It was a short one, and the whole time was occupied in passing appropriation bills. In fact, while Johnson was at the head of the administration there was no disposition to do anything until after Grant should come in, so I went back to California once more, and kept up communication with financial men all the time; but it did not succeed in doing anything. In the summer of 1869 the Ways and Means Committee paid a visit to California. I saw them in San Francisco. Mr. Hooper of Boston was the acting chairman; Mr. Schenck, the chairman, having gone over to Europe. I saw the importance of getting those gentlemen over to Virginia City. They were a very influential committee; a committee composed of gentlemen of the highest standing, and I urged them all personally in San Francisco to go over to Virginia City.

VISIT OF THE WAYS AND MEANS COMMITTEE.

While they were in San Francisco of course they were more or less shown around by the Bank of California. They could not help that, because they are prominent people, and have ramifications among all the wealthy residents of the Pacific coast; in fact, they run things out there pretty much, and they entertained those gentlemen to some extent. I urged them very much to go to the mines on their return to the east. Well, they told me that they would certainly go; they promised me faithfully, every one of them, that they would; but the Bank people, who had heard, in the meantime, of the determination of the committee, said *they* would take them over. I told them "all right." It could not be helped. The Bank folks had them in charge. They for a long time endeavored to persuade them not to go, but when they saw they were determined upon making the trip, they concluded to take charge of the party. They came over to Virginia City, and they were the guests of Mr. Sharon; but they had promised to come and see me. I could not possibly call to see them,

being, as they were, in the house of my enemies. But they did come to see me at the hotel. They had meanwhile visited some of the mines and seen that I was correct. They were such thoroughly intelligent gentlemen, that they perceived at once that I had been representing things as they existed; and the very fact that this Bank of California was trying to injure me and denounce me made them the more earnest in my favor. Mr. Sharon told Governor Blair (and there is no more thoroughly honorable man than Mr. Blair in the United States) that they wanted to drive me out of the country. They didn't want the tunnel built. I showed them the lay of the country, and they came away most fully convinced of the justice of my case and the outrageous character of the persecution to which I was subjected. I think it was a very fortunate circumstance that these gentlemen came over there, because I thought it would secure to me at last a hearing in Congress. They became entirely satisfied that what I had stated in regard to this undertaking was correct; they went down into those mines in that terrible heat, and came near fainting in the attempt. Mr. Hooper of Boston, Judge Kelley of Pennsylvania, Mr. Maynard of Tennessee, Judge Marshall of Illinois, Governor Blair of Michigan, and Mr. Brooks of New York all went down into those mines. They saw it all; and if you ask any of those gentlemen about it, they will express but one opinion, every one of them.

SPEECH AT VIRGINIA CITY.

Well, I had now gone on some years in this affair. I was about getting crushed out by the bank. They were getting more and more bitter as the time passed, for they were annoyed at my persistence, which prevented them from starting the tunnel themselves. I had no chance to explain myself to the public. They owned all the newspapers, and they wouldn't print anything about the tunnel either for pay or otherwise, and I made up my mind to get up in Virginia City, right in their midst, show up

their rascalities, and explain the persecution they had instituted against me. I made a speech there, and that speech has been printed. (a) In it I made an appeal to the workingmen, the men who have to delve and toil in those mines with the thermometer at 100° and 110°: men who become consumptive working in that heated and foul atmosphere. I explained it all to them, and appealed to them that if each one would put in \$5 or \$10 apiece we could go on with the work and carry it out. Why, there was the greatest enthusiasm about this matter. They would not go to bed that night, but stood about the streets talking it over. They thought they could carry it out at once. The Miners' Union subscribed \$50,000 then. That helped to start the work going. These laboring miners did that. Of course they received an interest in the Tunnel company, and they put in this trifling amount of money. I told them that if they would go in together and put in \$5 a month apiece, they would own the tunnel in time and would own the mines. Mr. Sunderland has quoted me as saying that the Tunnel company would own the mines, but he has not stated in what connection the assertion was made. I did tell these people that they would and should own the mines. I told them to join together into a great co-operative association and build that tunnel. I told them they were spending \$5 a month apiece for whiskey; I said, "Put it in the tunnel." That, for 3,000 miners, would have been \$15,000 a month. If they would join together in this great work the politicians out there could not afford to oppose them. Well, they came and subscribed to the stock. They put in some money.

Mr. Sunderland has denounced that speech as the speech of a demagogue. He says I was inciting these men against the owners of these mines. These men were already bitter against this Bank of California; and I told them *not* to use any violence. I told them to go in and own this tunnel. Mr. Sunderland says that was the way to incite them to violence. I did not so understand it. (b)

(a) See Commissioners' Report, p. 48. (b) See Commissioners' Report, p. 48.

START WORK ON THE TUNNEL.

Well, we at last set to work on the 19th of October, 1869. We had raised some money over there and in California, and we started work. We had some festivities when we started. Many of the laboring men came down, and the officers of the laboring associations; but nobody from the Bank of California showed himself. They kept away at that time. We started the tunnel going on a small scale; for our means were limited; but we were acting under the rights given us by Congress.

We started in, and we simply made a beginning, it is true; but, having started, I thought we better incorporate as a company in San Francisco. This was in December, 1869. In the spring of 1870, while I was managing our financial affairs in California, raising more money to carry on the work, I received telegrams from Washington that I had better come on there right away; the bank had sent men there to get our franchise repealed. So I rushed off. I went overland, and came to Washington. What did I find? Why, that Mr. Fitch, our Representative from Nevada, had introduced a bill to repeal the third section of the law of Congress which secured us our royalty. That was the new dodge of the Bank of California to break us up. They had hired newspapers to abuse me. They abused me in the worst possible manner, and warned people from coming in with me; but the miners all understood it. They are laboring miners, who work in the bowels of the earth, and go down 1,000 or 1,200 feet, and bring out the rock. These men understood it all. They put in their money; and when the bank saw that we were going ahead, and running this tunnel in, with the chances of cutting a vein any day, they became alarmed, and hurried on to Washington to get this law repealed.

THE BANK ATTEMPTS TO REPEAL OUR FRANCHISE.

Mr. Hillyer, a prominent lawyer of Nevada, had been sent on, and tried to get that law repealed. Perhaps some

of you gentlemen recollect the fight that we had over that bill in the Fortieth Congress. Then my good fortune was that these gentlemen of the Ways and Means Committee had been over there and seen it all, and they stood by me. If they had not been over there, I should have been beaten. Mr. Blair stood up for me like a man. So did Judge Kelley. They all stood up for me. Those that did not make speeches went around and told the Representatives that this was a great outrage about to be perpetrated, and they protected my interests; and the members of the Mining Committee of that and the previous Congress all stood up for me. The Committee had made a unanimous report against the repeal, with the exception of Mr. Sargent. Judge Orange Ferris, a man as true as steel, was chairman, and had charge of the bill; he made a gallant fight, and was assisted by Mr. Strickland and all the other members of the Committee. Coming here in March, I had no time to see the new members of Congress, for the matter came up on the 17th of March, after I had just arrived here in Washington, and they had it all cooked up. They had had no bill printed, so that nobody should see what was being done. But I had it printed myself. I had some other documents printed which showed them up. Here is one of them. That bill was printed for the first time in this document. They had put that bill in writing, and being filed away amongst the Speaker's papers, it would have remained there until it passed, without my knowing anything about it, if my friends had not informed me, and if I had not come here. The vote upon the measure was 124 to 42. (a) General Banks doubtless recollects it. He voted against that bill to repeal our rights. After this bill had been defeated in Congress, I had to remain here to watch these people, because I knew they would try to steal in something or other, and get it through in an underhanded way. I asked to have a provision inserted in a general mining bill in the Senate, protecting my rights;

(a) See Congressional Globe, March 17, 22, and 23, 1870.

and Judge Trumbull, of Illinois, stood up for our rights, and showed that this sort of thing ought not to be allowed. So they protected me in my rights again.

WAR BETWEEN PRUSSIA AND FRANCE.

Then I commenced negotiations in Europe once more. I had a gentleman over there, an American, who had been out in Nevada, and he tried to raise this money in London. While he was doing that, he received a proposition from Paris and went over there, and made some preliminary arrangements to furnish us with 15,000,000 francs. That was in June, 1869. I was waiting for Congress to adjourn, and wanted to sail for Europe on the 20th of July. I had arranged to sail with Reverdy Johnson, of Baltimore, our former minister to England; who had agreed to go over to Europe to assist me. He was to sail with me on the 20th of July. He was at Baltimore, and I was here in Washington. I met him once in a while, and we talked the matter over. While he had been American minister to England he had made a great many friends over there, who I thought would probably assist me, not knowing for sure whether this 15,000,000 francs loan would be consummated. I thought I better have all the assistance I could get. I received letters from Reverdy Johnson while I was in correspondence with him on this subject, written in the early part of July, 1870, when this war cloud arose. He wrote me, about the 10th of July, it was no use to go over, and sure enough on the 15th of July, when I had reason to suppose I had secured all the money required, news came that war had broken out between France and Prussia. That broke up our negotiations. Not another word was said about it. You could not raise \$5 for any enterprise whatever in Europe or America. After all this fight in Congress; after showing the injustice of the movement against me, after this great victory, and believing the road to success clear now, when I was almost certain of getting the money required, the war broke out and spoiled all.

What was I to do? I couldn't raise one dollar in Europe or in the United States; so I returned

BACK TO NEVADA AGAIN.

We carried on our work all the time, struggling to get money to pay for it. We were paying \$4 a day to our miners, in 8 hours' shifts, that is \$3 in money, and \$1 in stock. We were using powder, tools, and timbers. We had to put up steam machinery, and I had to provide the funds or stop the work, and that I was determined should not happen. I tried to get along the best way I could, waiting the termination of that European war, intending to commence negotiations for money anew.

Of course that Paris matter was broken up forever as soon as that war commenced; but I thought I would probably be able in England, or other parts of Europe, to raise the money needed.

In December, 1870, I was back in Washington. I could do nothing in California, and I thought it probable I might induce Congress to do something in this matter. I had to come here to watch these people anyway, because I knew they would smuggle in something or other into a law to injure me if I did not. It was a most mortifying condition of affairs to me, to see some of the Representatives from the Pacific coast arrayed against me. They nearly all opposed me. They knew the Bank of California was the stronger, and so they helped the bank. I was the weaker, and they tried to kick me out. That is the way some of our Pacific coast politicians do. Right or wrong, you always find them on the strongest side, or the side which they expect will win. That is a fact, and I know it.

APPOINTMENT OF A COMMISSION.

I came back to Washington, I say, in December, 1870. It was another short session. I watched after these people. The agents of the bank kept up their misrepresentations, telling members that the tunnel was all a humbug; it was not necessary; that the mines had given out; that

there was no need for a tunnel. In the spring of 1871, in order to settle this affair at last, after all these years of labor and fighting and attempts to drive me away from this undertaking, I asked for a commission to go out there. I said to gentlemen in the House and Senate, "Send a commission out there, and let them report upon this question, and let them see what there is of it, and whether I have been telling the truth or not;" and a bill to do this passed both branches, and the President signed it on the 4th of April of last year. I thought that would settle the question for good. Gentlemen of the highest character would be sent out to investigate this subject, and there would be no more caviling about it. It would stop the misrepresentations of the bank, because we would get these commissioners to go there and examine into all the facts. And the President appointed Major General H. G. Wright, (and a more honorable gentleman never lived; a high-toned, excellent man;) Major General John G. Foster; and Professor W. Newcomb, (a gentleman of scientific attainments and straightforward, honorable character.) These commissioners saw as soon as they were appointed what there was about this; they saw that the Bank of California was against me. They saw there had been a great fight. They became rather timid. They did not know precisely what course to pursue. They saw they might get placed in a false position. They would not say much to me after I arrived out there to meet them. We were all very friendly, but the bank made desperate efforts to impress them their own way. I saw that they would be, to a large extent, under the guidance of these bank people, of the superintendents of the mines, some of whom are very much under the thumb of this bank, which regulates matters over there; and I perceived the danger that they might not get at the whole truth. They were very cautious, I must say, and careful, and I thought they would try to get at the facts; and no one who has listened to the testimony, particularly of General Wright or Professor Newcomb, can help thinking that they are men of the highest truth and character. They

made straightforward answers to whatever questions were asked them.

EXAMINATION OF THE MINES BY THE COMMISSIONERS.

Well, these gentlemen remained some time over there in Nevada. They visited the mines under the guidance of the superintendents, (a) and there are probably 200 miles of drifts in those mines. Why, I can take you in those mines and give you half a dozen views of the whole matter. You would not know the difference. (b) You cannot see the water in the mines. There is a sump (c) covered over, way down, that they pump out of. They might take you into comparatively cool drifts, where the ventilation is good; but these gentlemen found the thermometer was 110° in some places, notwithstanding.

They went down to the mouth of the tunnel several times. They went down there and saw it, and took great care in examining it; but, surrounded as they were by the satellites of the bank, who were straining every nerve to impress them against the tunnel, it is a marvel they did as well understand the matter. This man Sharon told them the first time he met them that he was going to break up this tunnel. (d) During the examination, I asked General Wright whether he thought Mr. Sharon would set aside a law of Congress, and he said certainly he thought he would; he was going to break up the tunnel if he could. These bank people come here to run Congress. They would like to run this Government; and what I want to find out is, whether they are going to run this Government or whether Congress is. They have been running the legislature out there, I know. I do not think they can succeed quite as well here.

ANOTHER TRIP TO EUROPE.

While these commissioners were out there, some gentlemen arrived there having connections in England—the

(a) See Test., pp. 167, 182.

(c) See Test., pp. 183, 184.

(b) See Test., p. 183.

(d) See Test., pp. 164, 165, 177, 355, 356.

same parties that had been negotiating for me before over the water—and I showed them the whole of this affair again, and they investigated it and set out for Europe; and, while I was still in Nevada, I received dispatches from them, that probably they could arrange some financial matters for me over there. So I remained in Nevada until the 15th of August. The commission was still there at that time. I then started for New York, and on the 30th of August I sailed for Europe. I came to London, and in a few days arranged for \$650,000 in gold coin. I remained there a few days, and went to Paris. That was this last year. I went to Paris, and then came right back to the United States, within thirty days from the time I had left New York; and from New York I proceeded directly to California and to Nevada. Having the means now to start the work on a large scale, we set all the shafts going, buying all the necessary machinery, and employing all the people that were necessary; and our whole works have been in full progress since last December. We are working day and night, and we have some 300 or 400 men employed. We are pushing the work ahead just as fast as we can; (a) and I believe in two or three years the whole tunnel will be finished to the Comstock lode, provided we can secure the balance of the money. I will state that, since I came from Europe, we have made another arrangement over there for \$800,000 more, so that we have now \$1,450,000—a pretty good sum towards constructing that tunnel. It gives us a good start, and we do not owe a single dollar to anybody. If we get any loan through Congress, we can give the Government a clear first mortgage on all this vast property, entirely unincumbered, and with a million and a half of dollars already invested.

THE COMMISSIONERS' REPORT.

After we had everything in running order out there, I started back to Washington last January, but, being de-

(a) See Report of Superintendent of Sutro Tunnel for first quarter 1872.

layed on the way by a snow blockade in the Rocky Mountains, I came here rather late. When I arrived here, I found that the commissioners had sent in their report to Congress; and here there was another disappointment. I had begun to think I was entirely out of the woods, that there would be no more chance for misrepresentation now that these gentlemen had been out there, who, I had been led to believe, would give the most complete and exhaustive statements in regard to the mines and tunnel. I was very much disappointed in regard to the lack of information about several important facts. Certainly a great many other points are stated by the commissioners which are conceded to be absolutely correct.

They state that the tunnel is entirely feasible. (a) (Well, really nobody ever doubted that except the California Bank people, who said the tunnel could not be made.)

They give the cost of the work at \$4,500,000. (b) They state that it could be completed in three or four years; by machinery in two years and a half. (c)

They also state in their report that the yield of the Comstock mines heretofore had been \$125,000,000, and that the present yield is \$15,000,000 per annum. (d) These latter facts they ascertained from the published reports and from the books. There is no question about those points. Nobody doubts them at all; they are patent to everybody that lives out there.

Then, furthermore, they declare the Comstock lode to be a true fissure vein, reaching down into the earth indefinitely; (e) that those mines will be worked as deep as mechanical means will allow; and that the amount of low-grade ores in the lode, which cannot be taken out now on account of the expensive system of mining, is almost unlimited in extent; that that class of ores which is abso-

(a) See Test., pp. 314, 321, 322, 323; also Commissioners' Report, p. 13.

(b) See Commissioners' Report, p. 14.

(c) See Commissioners' Report, p. 14.

(d) See Commissioners' Report, p. 15.

(e) See Commissioners' Report, p. 15.

lutely known to remain in the mines is immense. (a) There is no theoretical conclusion about that. That ore they ascertained to exist, and conclude that it has almost no limit.

IN WHAT THE COMMISSIONERS WERE MISLED.

They also state that there would be two important veins cut in running the tunnel in. (b) On all these points the commissioners are perfectly clear. Those are all points which they could either ascertain from their own observation or from records and authentic statements which have been published. They are able engineers, and their calculation upon the cost is also as reliable as the nature of the work will allow. They evidently tried to arrive at a fair conclusion in that respect.

But now let us come to that part of the report which, from the manner it was arrived at, must prove very unsatisfactory indeed. When they came to the important points of drainage, transportation, and concentration, what did they do? Why, they addressed a note to the superintendents of those mines, the employes of the Bank of California, and asked them to answer certain questions. The important part of their report they proposed to base upon the evidence furnished by the superintendents. (c) They were to tell them how much water there was in those mines. They were to tell them what facilities there were for working those mines, and what they thought of the Sutro tunnel; and they readily answered all these questions, and the commissioners, taking those reports, gave their figures on the basis furnished thereby. (d) What reliance can be placed upon these deductions, when we know that most of the superintendents are the sworn enemies of the enterprise? The commissioners' comparative cost of working by means of the tunnel, and the way they are doing it now, is certainly erroneous. These people were all interested. Their

(a) See Commissioners' Report, p. 20.

(b) See Test., pp. 151, 152, 205, 215, 286, 287, 429, 430.

(c) See Commissioners' Report, p. 8; also Test., pp. 2, 3, 4, 14, 15, 97, 201, 228, 307, 329, 374.

(d) See Test., pp. 2, 3, 4, 14, 15, 97, 201, 228, 307, 329, 374.

profits depend upon carrying on these mining and milling operations as they are carried on now. They are all getting rich and fat on them at the expense of the stockholders. They are wealthy. They want to maintain the present state of things. There are manipulations going on there which it is not for the interest of the country to have go on. These commissioners are old army officers. They are not quite up to the rascalities of that bank ring out there; not quite up to these stock-jobbing operations. They took many things for granted which these men told them; took it all for gospel; thought it was all just so. They were not sharp enough for them at all. Reading their report, it must strike you that they rather tried not to offend either side. They did not make any positive report. They were deceived to some extent by those people out there. There is no question about that.

EXAMINATION OF THE COMMISSIONERS.

It appeared to me absolutely necessary, in order to arrive at all the facts and set matters right, to request the chairman of the Mining Committee to ask that these gentlemen be cited before the committee, and the Secretary of War was asked to have them ordered to Washington. So they arrived; they testified; and we have the result in 810 pages of printed matter, making the case as clear as you can make any case in the world. It shows everything. We did not leave a stone unturned to show up every point. Some of the gentlemen of the committee must have become tired and weary. It was rather an imposition to ask the members of the committee to come to twenty-five hearings, night after night, although it was probably somewhat interesting to them. There are a great many scientific facts brought out in the evidence. It is a valuable book on mining, a great deal more so than a great many other books printed by Congress; and that book is a complete confirmation of everything that I have said and written on the tunnel for the last eight years. Every statement I have made is borne out there by these witnesses.

THE TESTIMONY MAKES A CONCLUSIVE CASE.

I am glad to be able to submit the whole case upon this testimony, and, taking it altogether, it is a most conclusive argument upon the importance of that tunnel. I cannot ask members of Congress to read the whole of that volume, but I suppose they can some day look it over and draw their own conclusions. We went along, and the three commissioners were examined; and, by the by, they were all cross-examined by the attorney of the Bank of California, Mr. Sunderland, sent here from the Pacific coast to get out all the damaging facts he possibly could. He brought out everything he could, but he did not bring out one single fact that goes against the tunnel in that whole examination. After the commissioners had been examined, the bank party became alarmed. They saw that they were gone up; that they had no case; and Mr. Sunderland telegraphed to Nevada for two of those superintendents, who had made statements to the commissioners, to come on here, in order to set themselves right. He appealed to the committee, and told them that he must have those people here; that their veracity had been attacked. Well, we consented to it, and he insisted on examining six more witnesses; and we asked the same privilege. Then the committee passed a resolution that there should be six more witnesses examined on each side; that there should be no more than eight hearings; and that the whole testimony should be closed by the 1st of April. Well, the Bank of California sent Mr. Requa, the superintendent of the Chollar Potosi mine, and Mr. Batterman, and they were going to annihilate all the previous testimony. (a) The first question I asked both of them was whether they were mining engineers. (b) No; never had any experience on any mines excepting those on the Comstock lode. They were glad to get away from us. I asked them who sent them here, and they had to admit that they were sent by Mr. Sharon, the

(a) See Test., pp. 549, 550, 575. (b) See Test., pp. 104, 462, 463, 504, 681.

agent of the Bank of California; and they were glad to get off when we let them. They were in tight quarters. I had Mr. Requa tell how much profit the Chollar Potosi company had paid to the Union Mill and Mining Company (which is owned by the Bank of California) in one year. \$376,000. He had to tell all about that. That is their kind of operations. They paid them over \$1,000,000 for working in one single year, and the clear profit paid to the Bank of California out of that sum was \$376,000. (a)

TESTIMONY OF PROFESSOR RAYMOND AND MR. LUCKHARDT.

The committee thought, since there was more testimony to be heard on this subject, they had better cite Mr. Raymond, the United States Commissioner on Mines and Mining, (b) and hear what he had to say on this question. Mr. Raymond came here at the request of the Secretary of the Treasury. Now, here we had a distinguished mining engineer before the committee, a man of intelligence, a student of Freiberg, a man who had visited nearly all the mines of Europe and in this country, who is president of the American Institute of Mining Engineers. Here was valuable testimony. The evidence in favor of the tunnel became stronger and stronger.

Then we examined Mr. Luckhardt, (c) who was employed by the Bank of California (d) for five years to make reports, so as to furnish them with secret information which the public could not get. Luckhardt's testimony is most conclusive, so is Mr. Raymond's. They are scientific men, and they showed the facts. It was about as complete an investigation, I believe, on a single subject, as has ever taken place in Congress, and I do hope that members will take time to read that book or devote a few hours to it.

There is an index attached, and part of it will be found quite interesting. The testimony of Luckhardt and Ray-

(a) See Test., p. 520.

(b) See Test., pp. 597, 598.

(c) See Test., pp. 677, 678.

(d) See Test., pp. 678, 679, 680, 681, 682, 722, 723.

mond is highly valuable. It will be looked upon as a valuable acquisition to mining literature. As I have said, that evidence is a complete confirmation of my statements on the subject of the tunnel during the last eight years. These Government witnesses have indorsed them. Your commissioners have set themselves right on every question by their testimony, and nearly everything has been finally established.

CORRECTNESS OF STATEMENTS ATTACKED.

Mr. Sunderland, in his argument, has tried to create the impression that some of my statements are incorrect. He says I have stated in one of my pamphlets that the tunnel will cost \$1,950,000; and that the revenue, during its construction, would be \$500,000; consequently, all the money required would be \$1,450,000. Now, gentlemen know how difficult it is to make an estimate for a work of that kind. You have an illustration of that in the Hoosac tunnel, in Massachusetts. They thought it would only cost \$2,000,000, but it has cost much more. The \$1,950,000 given in my pamphlet seven years ago was for the main tunnel only. Branches were not included in that; and those figures were given in gold. Then, Mr. Sunderland attacks the statement made by the committee of the 40th Congress. The committee stated that that tunnel would probably cost \$8,000,000. These gentlemen in Congress had reports on the Hoosac tunnel and every other tunnel. They made the figures by drawing comparisons between the costs of hundreds of tunnels in Europe, and they arrived at the conclusion that the whole work, with the branches, would probably cost \$8,000,000 in currency. We have now had a commission out there of very able engineers. There can be no question as to the high order of ability of both General Wright and General Foster as engineers. They have figured on it carefully, and they declare it will cost \$4,500,000. Now, Mr. Sunderland and these bank people have searched for years to bring out something against me and that tunnel enterprise, and

he has discovered that I said at one time the work would only cost about \$2,000,000, and that is about the most damaging fact he can discover.

TOTAL YIELD OF MEXICAN MINES.

He also says that I have stated in one of these books here that these mines on the Comstock produce nearly as much as the whole of Mexico, and that it has been shown in this examination that the mines of Mexico produce \$29,000,000, while the Comstock produced only \$18,000,000 in one year. That is another damaging fact, by which he wants to impeach my statements.

Now, the fact is, the mines of Mexico, between 1795 and 1810, when in their most prosperous condition, were yielding more money than they ever did at any one time before. They were yielding then, according to Humboldt, \$22,000,000 a year. In 1810, when the revolution took place, it dropped down to \$9,000,000 at once, and it went down as low as \$4,000,000, I think, for a number of years. (a) It rose from that to \$15,000,000 or \$16,000,000, until within the last few years, when, under the administration of Juarez, such an impetus was given to mining, that it came up last year, I believe, to \$29,000,000. That is one of the damaging facts Mr. Sunderland brings out in all this amount of testimony against my statements, which I claim now are as nearly correct as they could have been given with the information in my possession at that time.

Then he gives us some more figures here. He says I state in that book it costs \$4,000,000 a year to pump the water out of the Comstock. The commissioners say it costs \$124,000. I admit that the former is a large figure. But, supposing all that district be opened up, as it should be, to a depth of 2,000 feet, and all the mines connected, it would nearly cost that amount to pump the water out, counting all the machinery which would be required, and the wear and tear, and considering the great cost of machinery at

(a) See Humboldt's Political Essay on New Spain.

that time. Well, the commissioners put it at \$124,000. That was taken from the statements of these superintendents, the agents of the Bank of California. I will say now that it costs over \$1,000,000 at the present time, if you count the whole expense. If you get down 2,000 feet all along the lode, it will cost an enormous sum. They did not include any indirect cost in this report made to the Government, and that causes by far the greatest part of the cost of pumping.

PRESENT MANNER OF MINING.

We have shown, by the testimony of every one of those gentlemen, that these mines are worked for stock-jobbing. In order to explain myself, I will have to go into the mode of mining as it is carried on now. These mines are opened by means of shafts all along this lode. There is a shaft sunk down every 2,000 or 3,000 feet. There is large machinery on these shafts. (a) The water is pumped out by means of great steam engines from the bottom of these shafts, and the ore is hoisted out to the surface, and then carried on this railroad we have spoken of to the mil's. In working mines in that way they open one level only at a time. It is immensely difficult sometimes to go down a single hundred feet in these shafts, and open up a new level, because the water which you encounter and the difficulties of pumping are very great. But they do not want to open up more than one level at a time, because they want to keep the condition of the mine in the dark.

STOCK-JOBGING OPERATIONS. (b)

I want to explain now how these manipulations are carried on. These mining companies are joint-stock companies, and they are used for speculation by the people who buy the stock, which is scattered all over the country. It is held on the street by brokers, and they speculate and operate

(a) See Test., pp. 32, 33, 34, 179, 203, 204, 213, 371, 607, 644, 648, 691.

(b) See Test., pp. 165, 168, 174, 178, 215, 278, 300, 301, 342, 343, 344, 466, 468, 601, 682, 683.

in these stocks for the sake of making money out of the rise, or they sell short to make money out of the decline. Consequently the mines are really owned by nobody. (a) Some mines, when they get in very fine condition, are bought up and looked after by the owners; but, as a general thing, they are owned by nobody, as far as legitimate mining is concerned. (b) Men dealing in these stocks do not find out whether the mines are worked to advantage or not.

The people engaged in this kind of operation are of a very speculative turn of mind. They invest \$1,000 in a certain stock, and when they think they see another chance they pawn that stock and get \$500 on it, and buy more, and then they pawn that again; and the Bank of California has started an agency at Virginia City, put a man in charge by the name of Sharon to manage the bank, and they play a very smart game there. They loan money on these shares. Everybody speculates, every miner, or chambermaid, or washerwoman; and as soon as they get into one stock they want to speculate in other stock, and they have to pawn it, and the Bank of California, a regular pawnbroker shop, loans money on them. (c) They have men throughout these mines who keep them informed. In fact, they employed Mr. Luckhardt for five years to furnish a daily report about the condition of the mines on the Comstock.

HOW TRUSTEES ARE ELECTED. (d)

Now, mark what these people do. When the election comes off, all this stock stands in the name of the Bank of California, because when they loan money on the stock it is transferred to them or to one of their clerks. They do not place it in the name of the bank, which would make it responsible for debts, but have it transferred to the name of a clerk. Then, when the annual election comes, they

(a) See Test., p. 178.

(b) See Test., pp. 174, 175.

(c) See Test., p. 196.

(d) See Test., pp. 346, 347, 348, 349, 350, 687, 688.

vote all this pawned stock and get all the proxies they can, which gives them a majority, and so they put in a board of trustees of their own making. They do not own any stock in many of these mines, but they put in a board of trustees and manage the mine. They also loaned money to many of these mills, and afterwards foreclosed the loan, and got hold of them for one-fifth of the price. Mills that cost \$5,000,000, they obtained for less than \$1,000,000. (a) They had the management of the mines, and withheld the ore from the mills they wanted to break up. Thus they secured many of these mills, (b) and they get \$12 for every ton worked. It has been shown that they can reduce in their mills 1,000 tons a day, for which they get \$12,000, including freight on the railroad, which they also own.

PROFITS OF MILLING.

We have the statement here of Mr. Requa, one of the bank's superintendents. (c) He says milling costs them \$4 50 per ton. Consequently they make—how much? Take \$2 off for hauling, that leaves \$10; \$4 50 from \$10 leaves \$5 50, and on a thousand tons (d) that makes \$5,500 a day clear profit. (e) That is what they make—\$5,500 a day clear profit. Now, by having control of a mine, it becomes very easy for them to manage to get out as much ore as possible; they do not care whether the mine makes any money or not, because they do not own the mine; they own the mills, and consequently they take out as much ore from these mines as they can, and if they have no ore, they take out bed rock; take out the country rock, that contains nothing at all, and send it to the mills and mix a little ore with it, and crush it, and get \$12 a ton for working that ore, and not enough comes out to pay for hauling sometimes. (f) They make \$5,500 a day profit, and it runs the mines behind. If they take out \$6 a ton, and the mill gets \$12, the mining company loses \$6 on every ton.

(a) See Test., pp. 351, 352.

(b) See Test., pp. 163, 354, 515.

(c) See Test., pp. 176, 535.

(d) See Test., p. 203.

(e) See Test., pp. 519, 520, 521.

(f) See Test., pp. 203, 297, 353, 686.

What is the result? When there is no money in the treasury and the mine runs behind, the trustees, who are the agents of the bank, put on an assessment, and, if not paid, the stock is sold out.

HIDING ORE. (a)

But the great game is this: By having control of a mine, they know exactly what is going on in that mine. If it contain but a little good ore, or low-grade ore, it sells at a low rate. They keep watching it; these superintendents have men in the mine watching; and when a body of ore is struck, they are shut up at once. Nobody is allowed to go in there except the few men who are digging. They put a bulkhead across. They just prospect it sufficiently to find out what it amounts to, and keep the men down there digging away, and treating them in splendid manner, (they give them champagne.) (b) The moment they find there is ore down there, they telegraph in cipher (c) to San Francisco, as it is shown in the testimony, and buy up the stock. (d) And sometimes this ring goes to work and breaks the stock down first before they buy; they start the miners on drifts in the wrong direction, and say there has been a cave, for fear anything would leak out about it. They take out poor ore, or bed rock, which necessitates assessments, and thus run the stock down. Everybody that owns stock is assessed, (e) and they get it all in the end. We had a striking instance of this kind in one of the mines lately. The stock went down to \$2 a share, when gradually the ring got all the stock concentrated in their hands—got it away from the poor fellows who were paying assessments (f)—and then they made known the existence of this ore, which they had concealed, and the stock went up to an immense figure. They are in a perfect fever just now. The stocks on the Comstock lode have gone up from \$3,000,000 to \$50,000,000 in a year. Just now the ring owns largely in stocks, and they will

(a) See Test., pp. 295, 166, 174, 176, 466.

(b) See Test., p. 175.

(c) See Test., p. 551.

(d) See Test., p. 175.

(e) See Test., pp. 176, 690.

(f) See Test., p. 300.

realize millions out of them, and they have managed such operations about twice a year since the mines were discovered. Most of the outsiders who buy these stocks get swindled in the end, and I suppose the people out there think that is smart!

CERTAIN RUIN TO OUTSIDERS.

When the stocks get about the highest the ring steps out, and a crash takes place, which ruins all the others. (a) And such a crash is impending now; it will certainly come before many months. It will appear very clearly to you, that this California Bank ring, or the Union Mill and Mining Company, (it is all one affair, as has been shown here,) are managing things over there just to suit themselves; (b) and the head manipulators are Ralston, the head of the Bank of California at San Francisco, and Sharon, their agent at Virginia City. They get the profits out of the mines and mills, and I tell you, gentlemen, they are making millions out of it. I do not wonder that Mr. Ralston can live in a princely residence, and keep 60 horses for his own use. The ring is filching it out of the people. They do not get it honestly.

These people are opposed to the tunnel, and why? If that tunnel goes in, it fully opens the mines; there will be no hiding; (c) from the surface down through the whole length of that lode a new basis of operations will be made; and it will lay open every mine down to the tunnel level—yes, every mine will be laid open. They cannot hide the ore any longer. That is one of the causes of opposition.

The second reason is, it will be a great deal cheaper to get the ore out through the tunnel; and we shall erect reduction works at the mouth, which can work so much cheaper and get more out, which will stop the whole of their milling operations. Now, to defeat this project they misrepresent it. They say the tunnel is useless. The truth

(a) See Test., p. 302.

(b) See Test., pp. 177, 178, 686, 687.

(c) See Test., pp. 193, 214, 278, 279.

is, it is going to stop these rascally operations, and that is why they oppose it. (a) These mines lose \$8,000,000 a year in the yield, as operations are at present carried on. We can get out \$6,000,000 of that at the mouth of the tunnel that they do not get out at all now; that is wasted now. I have tried to explain the management of these mines and some of the manipulations of the Union Mill and Mining Company, and hope I have made myself understood.

PERCENTAGE EXTRACTED FROM ORES. (b)

There is another most important item, which these people profit by in working these ores, and that is the tailings. (c) We have shown, by nearly every one of the witnesses, that they only get out 65 per cent. from the ore; consequently 35 per cent. remains in the tailings. The mines yield \$15,000,000 a year in bullion; that would therefore bring the assay value of the ore to \$23,000,000, showing a loss of \$8,000,000 a year in tailings. The Union Mill and Mining Company will some day sell those tailings, and get millions for them, besides the millions they get for milling the ores. That is what they get, and they get it out of the people who own the stock. That is a perquisite of the mills.

Now, Mr. Sunderland has tried to show by two of his own men, Requa and Batterman, who were sent to testify by the Bank of California, that they take out as much as 88 per cent. Every other witness has stated that they cannot take out over 65 per cent. One of the witnesses has said that they may get 72 per cent. Mr. Luckhardt, who was the most competent witness we had here, who was five years on the lode, and whose business it was to go down into these mines and examine them, and who is a scientific and educated gentleman and a mining engineer, says you cannot take out more than 65 per cent., because the other 35 per cent. are rebellious metal. You cannot

(a) See Test., pp. 177, 310, 311, 346, 355.

(b) See Test., pp. 159, 160, 256, 311, 354, 630, 631, 632, 706, 707, 708, 754.

(c) See Test., pp. 266, 310, 354.

take out the other 35 per cent. by amalgamation. I will add my own testimony to that. I have made repeated experiments for months and months—sat up all night in order to follow out some experiments—to find out what could be obtained by raw amalgamation, and I give my testimony that you cannot get out more than 65 per cent. I have analyzed what remains, and it is a combination of silver and lead, copper and zinc, and other base metals, and sometimes of sulphur. You might run it in the pans for a year, and could not get out any more by amalgamation. That portion of the ore has to be worked by smelting or chlorodizing-roasting, (a) and I would not care if they would send one hundred witnesses here to swear to the contrary. I know there must be some mistake about their assays or results somewhere; you cannot do it. Mr. Luckhardt most emphatically declares so.

Mr. Raymond states, that all the reports received by him give the yield at 65 per cent. It is no use for Mr. Sunderland, or the Bank of California people, to say that they get 88 per cent.; it is not so.

SIXTY-FIVE PER CENT. THE AVERAGE YIELD.

These rebellious ores are called in Mexico "bronzes." Every Mexican knows that will not amalgamate at all. You cannot do it. It cannot be done. Mr. Requa has told us they get out 92 per cent. He says that the Union Mill and Mining Company paid reclamations to his company. He has told us that they have paid during the last year \$16,400 in reclamations. In order to explain that, I will state that these mill companies have to guarantee 65 per cent. It is only a nominal guarantee. It does not amount to anything, because they take out just what they please. There is but one crowd managing it, but he says they paid this reclamation. The Chollar company took out last year \$3,440,023, and they had paid to them a reclamation of \$16,400. He wants to make out that they received more

(a) See Test., pp. 735, 736.

than 65 per cent., because the Union Mill Company paid that reclamation. (a) Now, gentlemen, I will tell you how much that amounts to—one half of one per cent., what they received back in reclamations, and he wants to make us believe that is a fact worth mentioning. Sixty-five per cent. were guaranteed, and they paid back one-half of one per cent. or \$16,400 on this immense sum of \$3,500,000 nearly. That is to make the people believe they pay reclamations. It is all a humbug. I do not believe they get out 60 per cent.—only make the people believe they get out 65 per cent. and over: (b)

Now, see what Mr. Luckhardt says about this. It is a very important point:

"Q. So they do not seem to get out more than 65 per cent. of the assay value of the ore which is returned to the mines?"

"A. I think a great many people there say that they get out 80 or 85 per cent., and I think, in some instances, judging from the character of the ore found, that it is possible to get out that, but not as a general thing, because the ores of the Comstock are of such a nature that any man who knows the nature of the ores, and knows how to judge of ores, would consider it to be a preposterous idea to get out 80 or 85 per cent. by crude amalgamation. By treating those ores by previous processes anterior as to amalgamation, you may get from 80 to 85 per cent., but I think from 60 to 65 per cent. is the general yield of those ores." (c)

In the cross-examination Mr. Sunderland tried to confuse him on that point, and wanted to know what experience Luckhardt had in milling. Now, Luckhardt is the most practically experienced man we have had here as a witness, and there is probably no man living at the present day who knows so much about those mines as he does. He was asked:

"Q. Then if that is the only experience you have had of milling, and the only opportunity you have had of knowing what percentage is saved from the assay value of the Comstock ores, how can you state that they only saved from 60 to 65 per cent.?"

"A. Because I have so frequently assayed those ores, and I know their character so well. I know what will amalgamate and what will not amalgamate; that is just as good proof to me as if I had stayed and worked there for twenty years." (d)

He is a scientific man. He knows you cannot amalga-

(a) See Test., p. 522.

(b) See Test., pp. 159, 160, 256, 311, 354, 630, 631, 632, 706, 707, 708, 754.

(c) See Test., p. 707.

(d) See Test., p. 759.

mate it, and that is exactly what I know. That disposes, I think, of that part of Mr. Sunderland's argument.

WATER THE GREAT OBSTACLE IN MINING. (a)

Now, in regard to drainage, which is a very important point, these people have strenuously tried to show that there is no water in those mines. They have tried to impress that on the people, and have hired the newspapers to say there is no water in the mines, and consequently, as they argued, there would be no necessity for the tunnel. They have done that for years. They have been trying by every effort to break up the enterprise, by saying there is no water in the Comstock. We have shown that to be false here by the testimony of every witness, and false by their own statements. Water is the great obstacle in mining. It has nearly ruined some of those mining companies. After the tunnel is run in, and these shafts which now exist are connected with it by bore-holes, such as you bore for oil-wells in Pennsylvania, the water will run out; nobody can deny that. (b) They have stated there are clay seams as tight as a bottle, and that the water will all stay in, but these bore-holes will let it run out. They have been denying my statements for years. I cannot inform the whole world. I have told them all they have got to do is to make a bore-hole, and repeated it a thousand times, and at last we have it on record to show, but they will keep on denying it notwithstanding. That is their style of warfare.

Now, as far as the Ophir mine is concerned, I put to General Wright some questions in regard to the quantity of water in that mine. We have the statement here of the former superintendent of the Ophir mine, who says that "it is a dry country, and there is no water in it; everybody knows it;" and I have shown here, by that same man's official statements, as they are called, how much water they took out of that mine every day. I asked General

(a) See Test., pp. 82, 87, 88, 89, 91, 96, 180, 182, 217, 304, 306, 307, 308, 330, 331, 333, 334, 335, 338, 340, 358, 359, 360, 361, 691, 692, 693, 694, 695, 697, 742.

(b) See Test., pp. 41, 42, 232, 675.

Wright how much they were pumping from that mine every twenty-four hours, according to this same superintendent's statement. He said the weight of the water was 336 tons, of 2,000 pounds each, per day, and they were only hoisting 12 tons of rock. They pumped that out, which is pretty nearly equal to lifting it out. Then I asked him as to the average per day for the year commencing with June, 1870, and ending June 1, 1871.

The average, he said, was $10\frac{3}{4}$ inches.

"How much," I asked, "would that be in tons in 24 hours?"

He answered:

"THE AVERAGE IS SEVEN HUNDRED AND EIGHTY-ONE TONS OF WATER PER DAY IN THAT ONE MINE." (a)

There it is—781 tons of water out of one of the mines every day for a year. Let me read that statement, furnished to the commissioners by Mr. Day. These people feel outraged because their statements are doubted here; they may be high-toned men, but they are in with the bank, and that condemns them. This is his statement:

"I hold that there is no more certain event of the future than that the water will decrease in the Comstock as the mines grow deeper, the opinions of Mr. Sutro, Baron Richthofen, or any other scientific gentleman to the contrary notwithstanding, and the idea of running a tunnel four miles or more in length, at an outlay of millions of dollars, to tap *what is almost certain to be very nearly a dry fissure, seems to me to partake of the absurd in the extreme. This is a dry country, and all who have looked upon it know it.*"

General Wright testifies that the average for last year was 781 tons of water per day out of that one mine—that identical mine of which that man was speaking, and of which he was the superintendent. Then I asked General Wright—

"Did you make any figures on the maximum quantity for the year, as stated by Mr. Day, which is 18 inches?"

And General Wright answered:

"Eighteen inches gives the weight for 24 hours at 1,313 tons"

That they had to pump out per day to get out 12 tons of

(a) See Test., p. 360.

rock. (a) That was shown by the testimony. In the Gould and Curry mine he says there was more water than that.

Then, if we take the aggregate of all the mines, it amounts to at least three or four thousand tons for every 24 hours that they are pumping out; (b) and then it must be recollected that these gentlemen were over there at the end of three years of immense drought. (c) The whole country had dried up. The springs had dried up. There was no water there, comparatively.

INDIRECT COST OF PUMPING. (d)

Now, gentlemen, the actual expense of pumping water is but a mere trifle compared with the indirect cost, which is perfectly fearful; while you are sinking a shaft, and are hampered with water, you cannot progress with your work; thus you are shut off for months sometimes, and cannot go on; and the expenses of the whole concern, for office, engineers, &c., are going on all the time. The indirect expense of working is probably three or four or five times as much as the direct cost. The commissioners did not bring that into account in their report at all. It is difficult to get any data on the indirect cost. I think Mr. Luckhardt was asked a question about the cost of raising water. He said:

"Where there is much water there is always a great retardation of the work."

"Q. Isn't that a greater expense than the actual pumping?"

"A. Oh, to be sure. The pumping itself is the least of the expense of getting rid of the water."

Now, as far as pumping water from great depth is concerned, I have telegrams in my pocket which came within the last two or three days, about this very Ophir mine and also the Savage. Mr. Sunderland has stated here in his speech that two-thirds of the Comstock lode is as dry as this floor; and that is what they have been trying to show for

(a) See Test., pp. 5, 6, 7, 13, 14, 15, 42, 305.

(b) See Test., pp. 84, 90, 95, 378, 379, 453.

(c) See Test., pp. 180, 181, 304, 307, 329.

(d) See Test., p. 772.

years; and I say it is not true. There is one dispatch dated April 13, the other April 15. One says:

"In Savage they had to stop working on shaft between 1,400 and 1,500 feet levels, on account of large volumes of water. Ophir also much troubled with water."

Dispatch dated 15th says:

"Expenses for pumping in the Ophir for March, \$5,800. This is official statement made by the superintendent."

THEIR OWN LETTERS CONDEMN THEM. (a)

That is on the 15th of this month. Now, I want to call the attention of the committee for a few moments to some extracts that we have been fortunate enough to get hold of, and at the same time I will reply to the motion of Mr. Sunderland to have that testimony stricken out. They have been denying for years that there is any water in those mines, and that has been their great fight all along; and when we offered this testimony—the extracts from letters written by this same man Day, whose statement I have just read, saying that "this is a dry country, and everybody that looks upon it knows it"—when we have that man's own letters, written to his superior officers in San Francisco from day to day, making reports of the mine, and have got these extracts sworn to by the present superintendent of that mine, he made a motion to have that testimony ruled out. Of course he would like to have that done. We have caught them in the act now. They have been telling untruths, and here we have the proofs on them. We have got them on the record. Here are this man's letters, which he wrote to the president of the company from day to day, stating how much water there is in the mine and how much they are troubled with water, and that very motion of Mr. Sunderland's is pending before this committee to have that testimony ruled out. On what grounds does he want it ruled out? On some pettifogging law quibble. He says they are "copies of copies." We ought to produce the originals. Why, gentlemen, they are copies made

(a) See Test., pp. 791-810.

from the press copybook. They are copies of letters sent to San Francisco, and the present superintendent copies them and swears they are correct. (a) The other evidence introduced here in the commissioners' report is not sworn to in any shape whatever. They want to get the truth ruled out by a legal quibble. Mr. Sunderland must think that Congress is a petty justice's court, where prisoners known to be guilty are often rescued on insignificant technicalities of the law. This is the best testimony we have got. It convicts them fully of a most outrageous perversion of facts. It also shows the difficulties of pumping, the breaking down of machinery, and the consequent enormous indirect expense. I will read a few extracts from that man's letters. He writes on June 10, 1868:

"Depth of shaft, 287 feet. I assumed full charge on Monday. Work at shaft is progressing as well as can be expected under the circumstances. We are raising a large amount of water, more than the pump we are using has capacity for."

Then, in the same letter, he says:

"If no accident happens to the pumping machinery within the next two days, the tank and screw drift, with the necessary machinery, will be complete to station the first plunge pump, and the shaft deep enough to swing the sinking pump for the second lift. That being done, I see no reason why we should not make good progress in sinking."

June 14, he writes:

"Friday we were occupied in making preparations for putting in two 12-inch pumps."

Gentlemen, I wish to call your attention particularly to the fact, that these extracts will show what the enormous, indirect cost consists of, independent of pumping. The commissioners only gave the presumed direct cost of pumping the water out.

On October 16, 1867, this same man (Day) writes:

"Large amount of water coming in from face of main drift, which is boarded up at present to prevent a run."

October 21:

"Large flow of water."

October 22, 1869:

"The pump rod, to lower pumps, broke at 8 o'clock last evening, and has not yet been brought to the surface. *One man killed this morning by the*

(a) See Test., p. 780.

cable breaking in the pump shaft. It is difficult to form an estimate of the delay it will occasion us."

They do not count the life of a laboring miner. They count the dollars and cents only.

October 24:

"Our present flow of water seems to be entirely independent of the water in the old mine, which I regard as indicating the existence of a body of ore to the north, and separate from that worked in the old mine."

November 6:

"The water is still rising in the shaft, and now stands about 270 feet from the bottom."

Mind, now, it says 270 feet of water in the shaft. They had to get out 270 feet of water in order to get to work again. Then he goes on to say, in the same letter:

"We are now taking water from the shaft at the rate of 20,000 gallons per hour; and when the machinery (hoisting) is ready for use, we will increase that amount 10,000 gallons. It is impossible, at this time, to form an intelligent opinion of the time that will be required to free the drifts of water."

November 10:

"Our misfortunes, in connection with the strike of water in Ophir, seem to follow us up. Last Sunday morning, when our second or lower plunger was covered about 60 feet with the rising flood, it very suddenly ceased to throw water, and is now about 200 feet under water. [That's a dry country!] We are building a 500-gallon tank to use with the new engine. With that, and the one now in use of 300 gallons, will enable us to raise to the surface 16,000 gallons per hour. As I stated in my last, it is impossible at this time to form an intelligent opinion of the time necessary to clear the drifts of water. Of one thing I am convinced, however: that our consumption of wood for the next six months will be perfectly frightful."

Recollect, gentlemen, if that tunnel had been made, every drop of that water could have been run out, and under our contracts they only have to pay us \$2 a ton for the ore taken out; and they have had no ore in that mine for five years; yet they protest against that tunnel. We have shown that $\frac{2}{3}$ of the mines have no ore; $\frac{2}{3}$ get the benefit of the tunnel for nothing; only $\frac{1}{3}$ will have to contribute to it.

December 15:

"Our progress in lowering the water is quite satisfactory. To-day it stands in the new shaft about 220 feet deep."

December 19:

"We are bending all our energies in our endeavors to free the new works from water, and gaining gradually upon it."

It does look like a dry country—"we have now 220 feet of water in the shaft!"

December 22:

"We are working all our machinery to utmost capacity, consequently accidents are liable to occur, but will guard against them as much as possible."

December 24:

"I assure you *there will be no let up*, and I believe few *drawbacks*, until we have the water well under control."

December 25:

"We have just succeeded in completing repairs to the lower plunger or middle pump, and made connection with the lower pump."

December 27:

"Yesterday evening we had the water at a lower point than at any previous time; but immediately after *the first earthquake* shock, it came up in the shaft some 25 or 30 feet in a short time."

December 28:

"We have the water down 25 feet below lower plunge pump, which leaves 175 feet in shaft."

December 31:

"Am pleased to be able to report to you a decided gain upon the water to-day—155 feet from the bottom; but it is *very stubborn*, and *requires heavy and persistent work*. I have no doubts as to the result."

January 5, 1870:

"We are crowding the work steadily in the shaft to-day. We have only 130 feet of water."

January 10:

"Since my last, we *had the misfortune to lose one of our large tanks*."

January 12:

"We do not succeed in getting the water in the shaft any lower than heretofore reported."

January 17:

"We are *still making vigorous battle with the water*, and driving it slowly down. We have it now within 110 feet of the bottom."

January 25:

"Owing to some delay in repairing tanks, the water is considerably up in the shaft."

January 28:

"We do not make rapid progress; but we do gain, and hold all that we get, which is encouraging, and shows that it is entirely a question of time as to when the new works will be cleared of water."

January 31:

"Mount Davidson has been shaking again, and consequently the Ophir water has increased, as usual in such cases. Sunday morning there was only 74 feet of water in shaft, and going down nicely. To-day there is 95 feet,

notwithstanding pumping and bailing has been going on without any interruption."

February 3:

"There was some delay last night, both with pump and large tank, consequently the water in shaft is higher to-day than usual."

February 12:

"Water at No. 1 at 600-foot station. *It sticks to that point with great tenacity*; but we are bound to get the best of it in time. We will be compelled to stop our large tank about three days next week, to refill the large cog-wheel."

February 14:

"*This water is a monster elephant*, but I know we can handle him; but it won't do to relax in the least the grip we have on it. In No. 1 the water is about 150 feet. In old mine it has lowered in last 48 hours 3 feet."

Now, what reliance do you place on that man? He told the commissioners it was a dry country, and they believed him.

February 15:

"Water in No. 1, 160 feet; filling wheel will be completed this evening."

March 4:

"*We are repairing again to-day* at shaft No. 1. About one half the cogs in large wheel gave out last night."

You see these are the indirect costs. These people have not mentioned them at all. They were working there four years in order to get down a few hundred feet in a shaft.

March 5:

"The repairs at shaft No. 1, spoken of yesterday, are completed, and machinery moving as usual: 150 feet of water in shaft No. 1."

March 18:

"Water in No. 1, 65 feet."

March 21:

"The bucket to our lower pump has been failing for the last few days. If we succeed in replacing with a newly-dressed bucket, there will be but little delay in pumping. Should we not succeed in this, an extra pump, which we have in readiness, will have to be lowered, which will cause at most only a few days delay."

March 22:

"At No. 1 we have not succeeded in drawing bucket from lower pump; have commenced active preparations for putting in extra pumps."

March 24:

"There is to-day 100 feet of water in No. 1; lower pumps working to about half capacity."

March 26:

"Water to-day in No. 1 is about 80 feet; will commence filling large cog-wheel this evening. You can assure Ophir stockholders that we are doing all in our power to reduce this water. Delays to some extent are unavoidable. There is no time when there is not a large stream of water coming to the surface at Ophir shaft, and it must tell before long."

March 31:

"Have just commenced lowering pump. Putting this pump in place is attended with so many difficulties, that it is impossible to say, with much certainty, the length of time that will be required, but probably about three days."

April 1:

"At shaft No. 1 we are still engaged in putting down pump; getting along very well; foundation to pump-bob is becoming a little shaky; and it may be necessary to overhaul it before making our next great effort at lowering the water."

April 9:

"At shaft No. 1 we have repaired old pump, and it is doing good work."

April 11:

At shaft No. 1 the drift is free of water. And right here allow me most sincerely to tender you, as president of the Ophir S. M. Co., and your associate trustees, my heartfelt thanks for the generous co-operations with which you have sustained me in this fight; for truly a battle it has been, of no ordinary magnitude, and I feel that a great weight of anxiety and responsibility has been removed."

Recollect, now, after pumping for years to get into that drift—doing nothing but pumping—he comes at last and says:

"No. 1 is free from water."

He thought he had got rid of the water, but he had not. He congratulated them too soon. That was April 11th.

On May 7th he writes:

"Increase of water referred to yesterday still continues, but I have no fears of being flooded."

May 16:

"Water about as last reported."

May 26:

"Quite an increase of water."

June 3:

"Last night, about midnight, the irons on one end of our pitman rod broke, which renders our pumps useless until repaired, which will not be before to-morrow morning. Consequently, our drifts are filling with water, but I do not apprehend any serious damage to them."

June 4:

"Started pump this morning at 7 o'clock."

June 9:

"The pump is laid up to-day, owing to the breaking of some of the upper gearing last night."

June 10:

"At shaft No. 1 *pumping machinery is very much demoralized*. The very best that we can do, it will probably require ten or twelve days before we can regain the ends of our drifts and resume work. I regret this very much, but do not see any way by which this accident could have been foreseen or avoided."

June 14:

"Depth of water, 150 feet."

They had it dry before; now it was filling up again.

June 16:

"Water is 175 feet in depth; and slowly rising."

June 20:

"Pump started last evening at 7 o'clock. The water is now lowered to a depth of 60 feet."

They put in so many more pumps that they could master the water at last.

On September 2 he says:

"The water is wholly under control of the pump."

February 16:

"In the upraising there is a slight increase of water to-day, somewhat impeding progress of work."

Then there is more trouble of water; but I will read no more. This man Day, I must remark, was discharged last December, because the bank ring lost control of the mine, and a new set of trustees came in; this is the first time we have been enabled to get at any of the mining company's books. The new superintendent came in January, and he writes on January 2, 1872, this year:

"There are three 12-inch plunger pumps, and one of 10 inches in service, and the fifth one, 10 inches, is under construction, and will be ready to put in place as soon as needed. *We are raising 146,000 gallons of water per twenty-four hours.*"

That disposes of this water question. I will comment on it no further. The commissioners went out there to find out all about these mines, and the quantity of water; and the difficulties of pumping it out, direct and indirect, was one of the principal questions to be decided. But they took the superintendent's statements, who told them

that it is a dry country, and they made their report, based upon the statements furnished by these people.

VENTILATION. (a)

I now come to the subject of ventilation, and a very important one it is in mining. I cannot go into the evidence at length which was taken. It would carry me too far altogether. We have asked every witness we had here about ventilation, and I believe they—particularly Newcomb, Raymond, and Luckhardt—spoke about the great importance of ventilation in mines; and what it accomplishes. In this connection I will read a short extract, one from the latest number of the “American Engineering and Mining Journal,” which came to-day, in which are a few remarks in regard to the commissioners’ report. It says:

“Our view is confirmed by an exceedingly elaborate and able treatise on the Comstock vein, its mines, and their intersection by the proposed deep tunnel, which has recently appeared in the *Berg-geist* of Cologne, one of the leading mining journals of the world. The author is Bergrath Burkart, who writes with all the published works on the subject before him, and draws conclusions quite favorable to the tunnel. His criticisms upon the report of the United States commission are rather severe; he blames the commission for accepting without question the statements of the mine superintendents, and shows that on the subject of mine ventilation these gentlemen have made, and the commission has too confidently adopted, *assertions wholly unfounded in the theory or practice of mining*. The particular proposition which Burkart attacks is unfortunately repeated several times in the Report and Appendix, viz: that when the tunnel is done, and the shafts connected with it, the air-current will go straight up the shafts; and that it will be impracticable to carry air to the headings where men are at work. *Of course this statement is ridiculous; and we are mortified that a foreign critic should find it in an official and professional document*. The superintendents of the Comstock mines are in many instances agreeable gentlemen, good business men, and excellent mechanics and engineers so far as their experience goes. It is their boast that none of them are “scientific theorists;” and no doubt their practical skill is better than mere theory for many purposes. But what they lack, though it may surprise them to hear it, is not theory, but practice. If they had had any real practical experience in deep mining and the natural ventilation of mines, they would not have talked such rubbish to the commission on that subject. When a man pronounces his particular locality to be “an anomaly;” says you can’t tell which way the air will go in his mine; that a deep tunnel connecting the bottom of his mine with daylight, on a level two thousand feet below the top, will give him no better ventilation than a level connecting the bottoms of two shafts, or that the natural air-current developed by such an enormous difference in altitude and temperature cannot be conducted wherever it is wanted throughout the mine, he is really propounding the wildest kind of theory, and what he needs is practice.”

(a) See Test., pp. 179, 199, 395, 624, 625, 700, 739, 749.

The opinion given here is by a gentleman who must be seventy years of age, for he is mentioned in Ward's book on Mexico, published in 1827, as a leading mining engineer in Mexico, and who is now looked upon as one of the great authorities of Germany on mining questions. This gentleman has taken a great interest in the mines of the Comstock lode and a deep tunnel, and he has managed to obtain all the documents and all the publications on the subject. I do really believe that he is more familiar to-day with that lode and all its general details than almost any other man, even out in that country where these mines are located. About the great improvement in ventilation of the mines there can be no question: (a) after the tunnel is completed, connecting with shafts from the surface 2,000 feet in depth, there will be a draft of air through there that will bring a welcome supply to the miners who are compelled to delve and labor for eight or ten hours every day in that stagnant atmosphere. We have reports here of a commission appointed by the English Parliament, and it is stated that forty-two per cent. of the miners die of miners' consumption; that they don't find it out that they are becoming consumptive until they leave the mines. They feel unwell, and go off somewhere to die. It is highly desirable to have the thorough ventilation which this tunnel will make possible.

In regard to the saving of timbers, we find, according to the testimony, there are 16,000,000 feet of lumber used in that lode every year. It will last two or three years with poor ventilation, and probably ten years on the average with good ventilation. That would make an annual saving of several hundred thousand dollars.

TEMPERATURE. (b)

The question of temperature is one of the great questions connected with ventilation, According to the state-

(a) See Test., pp. 168, 169, 170, 171, 199, 624, 625.

(b) See Test., pp. 169, 170, 171, 172, 627.

ments we have here, the heat in these mines is from 85° to 110°, and nobody will pretend to say that men can do as much work in a temperature of even 95° as they can at 70°. To put the lowest estimate upon it, twenty-five per cent. in the cost of labor will be saved by having those mines thoroughly ventilated, over what can be done with the present system of ventilation, where the thermometer rises to 100° and 110°; and when they go down deeper it will be still higher. One of the most important things this tunnel will do is this: it will allow the sinking of a great number of shafts, (a) which, as I have shown in this question of drainage, can only be made under the present system at an enormous expense. They were about four years and a half sinking the shaft of the Ophir mine, whereas if they had had a bore-hole down to the tunnel they could have put their shaft down in a year. If they had these shafts all in, they could connect them at each level, and have the most perfect system of ventilation possible. We have the testimony of these witnesses about the reduction of temperature on completion of the tunnel and the sinking of these shafts. General Foster states, on page 72, some facts in relation to this. I asked him:

"Should you think they could do two-thirds as much work with this high temperature as with the lower one?"

"A. I don't think they would do half as much."

On page 173 we have Dr. Newcomb's testimony. I asked him:

"Would you consider that the working capacity of the men employed in the mines below the 1,000-foot level would be increased twenty-five per cent?"

"A. To what other depth?"

"Q. To the tunnel level; from 1,000 to 2,000 feet?"

"A. Well, I should think it would. The lower a level the greater the heat, and the more difficult to work in the mines."

The other witnesses were asked a great number of questions on this subject, and they all agreed in their answers. (b)

General BANKS. There is no question about that.

Mr. SUTRO. These gentlemen have disputed this all the time. They make the wildest kind of arguments against

(a) See Test., pp. 42, 43, 44, 198, 438, 439, 440, 443.

(b) See Test., pp. 72, 74, 172, 173, 392, 393, 394, 395, 627, 699, 700, 703, 704.

it. Mr. Raymond and Mr. Luckhardt, and in fact all, agree there will be an increase of twenty-five per cent. in the capacity of labor. All these shafts could be made, and connections therefrom, with the greatest facility. It becomes a very important question, when you employ 3,000 miners at \$4 each a day, (\$12,000 a day.) If you can save twenty-five per cent. of that sum, or \$3,000 a day, you save over \$1,000,000 a year. That the commissioners have not taken into account at all.

TRANSPORTATION. (a)

I now come to transportation. Instead of hoisting out this ore as it is done now, to the top of the ground, then carrying it on this railroad down to the mills, (b) the ore may be lowered down at a cost of ten cents a ton, and it can be carried out on the railroad for from eight to ten cents a ton for the whole distance by stationary engines at the mouth of the tunnel, running cars in and out by means of a wire rope—ten cents a ton delivered at the mills at the mouth of the tunnel. (c)

General BANKS. What does it cost now?

Mr. SUTRO. It costs, according to the statements of these superintendents—

General BANKS. What do you think it costs?

Mr. SUTRO. It costs \$1 a ton to raise it out, and waste rock costs \$2, or \$3, or \$4 a ton, in mines where no ore is taken out. It costs more a ton to take out a small quantity than it does to take a large quantity. Then it costs from \$1 50 to \$2 50 a ton to transport it to the mills on the river. (d) Where we propose to erect the mills it will cost for transportation, according to the statements of several of the witnesses, twenty-five cents a ton. I put it at about ten cents a ton. According to these statements, hoisting and transportation now cost from \$2 to

(a) See Test., pp. 20, 21, 22, 24, 26, 202, 457, 458, 663, 704, 705.

(b) See Test., pp. 158, 309.

(c) See Test., p. 309.

(d) See Test., p. 158.

\$2 50 a ton, but I know it certainly costs from \$3 to \$4. General Dodge states it costs, on ordinary railroads, $1\frac{1}{4}$ cents per ton a mile. We have to transport it over four or five miles of tunnel. At five miles the cost would be $6\frac{1}{4}$ cents. Call it 10 cents to carry it out, and 5 cents to lower it to the cars. One of the commissioners gives the cost at about 35 cents. It is a known fact, in all the reports we have here on mines in Europe, that stationary engines, with wire ropes attached, for a distance of from one to five miles, are the cheapest appliances that can be used. It is cheaper than rolling stock and locomotives on railroads. It certainly would not cost any more than 25 cents under any circumstances. What probably costs them now from \$3 to \$4 a ton, if the whole truth were known, and the saving made, would amount to at least \$3,000 a day; that is, on the present yield, without counting any increased production.

REDUCTION OF ORES.

I will now refer to the reduction of these ores. At present they are taken to little mills all along these ravines, and down the river to mills, which are scattered all over the country, where they have no chance for concentrating independently of the difficulties from lack of water, which by themselves would be insurmountable. They lose 35 per cent., as I have shown already by testimony which cannot be questioned, although these people try to show that they have taken out as high as 90 per cent. It is not correct, and is shown to be impossible.

An important question connected with this tunnel and with the whole mining interest is the concentration of the ores. (a) We all know that the metallic parts contained in this ore are of greater specific gravity than the vein matter itself, whether it be limestone, or quartz, or any other gangue; and consequently, by allowing the pulp after it is reduced, to pass over concentrating tables, of which there is

(a) See Test., pp. 153, 248, 628, 708, 709.

a great variety in use in Europe, we can get rid, in ten tons of ore, of nine tons of waste, and retain one ton, which contains almost the whole value. (a)

LARGE ADDITIONAL YIELD.

Now, I mean to say this, provided there are concentrating works at the mouth of the tunnel, for the erection of which extraordinary facilities exist, that, after the ore is amalgamated, these tailings may be run over concentrating tables, and nine tons out of ten got rid of, which leaves us one ton to be reduced; we can put that one ton in a chloridizing Stetefeldt furnace, and get 90 per cent. out of those concentrations. In fact, the figures given by Mr. Luckhardt, which are quite conclusive, show that, instead of getting 65 per cent. out of these ores, we can get out 90 per cent., making full allowance for loss in concentration. Consequently, we save 25 per cent. above the present yield. The value of the ore extracted is \$23,000,000 per annum, (b) which yields \$15,000,000; the additional 25 per cent. would amount to \$5,750,000. (c) We get that out in addition to what is taken out now. The reason why we can do that, and they cannot at their present mills, is this: In order to establish those concentrating works, you have to have, in the first place, *an abundance of water, which the tunnel will furnish*, (d) and a large space adapted to that purpose. At the mouth of the tunnel there are hundreds of acres of the very best land, sloping down towards the river gradually—a gradual decline of 155 feet, in a distance of a mile and a half. It gives the natural slope necessary to make these concentrating works self-acting. The pulp, by means of the water, will pass from one machine to another, and it does not require the labor of hands at all hardly. It does its own work, and the worthless part of the rock, the nine tons out of ten, passes off, and we retain only one; and in that manner we can get some 90 per cent. out of the ore.

(a) See Test., pp. 205, 206, 207, 214, 629, 708, 709.

(b) See Test., p. 160.

(c) See Test., p. 161.

(d) See Test., pp. 628, 629, 710.

GREAT WATER POWER WITHOUT ANY DAM.

The commissioners have stated in their report, that there must be a large dam constructed on the river, in order to secure a water power. We have shown most conclusively, by several of the witnesses, that we can reduce the ore at \$5 a ton, and that the whole difference between water and steam power is only \$1 on a ton, and the saving, by means of concentration and otherwise, will probably average \$15. General Wright states that we would get 86,445 (a) horse power, if a large dam be constructed on the river; but if there is no dam at all constructed, if the water is taken out at that same point, we get 100 feet of fall at the mouth of the tunnel; and if reservoirs are provided in the mountains, to store up the water accumulated from rain and winter snows, to be used in summer time, we would still get 33,900 horse power, as deduced from the above figures, at the mouth of the tunnel; and all that is required at the present rate of production is 2,000 horse power; that is, to reduce 1,000 tons a day. That is all that is required; yet we would get 33,900 horse power, even if we make no dam at all.

Mr. Sunderland says the commissioners state, that if that dam is not made the tunnel will be of no value. That statement is founded upon the reports furnished by the superintendents, which we have already shown are not correct. We have the testimony of two of the witnesses, both Raymond and Luckhardt, that the tunnel itself will furnish water for all these concentrating purposes. (b) You will acquire a large quantity of water by draining six or seven or eight square miles of country, at a depth under Mount Davidson of 3,600 feet. It will be quite sufficient for all concentrating operations. That water is absolutely necessary, (c) and they cannot obtain it in the cañons, (d) while at the present mills on the river they cannot secure the

(a) See Test., pp. 380, 381, 382.

(c) See Test., pp. 153, 384, 628.

(b) See Test., pp. 628, 629, 710.

(d) See Test., p. 154.

proper fall, where they have only 8 or 10 feet of slope, and are crowded in near the banks of the river. (a) We have at the mouth of the tunnel 155 feet of fall. (b) We can erect the largest kind of concentrating works, (c) as I have stated, and concentrating can be done there, according to Mr. Luckhardt's statement, at 75 cents a ton. (d)

Mr. WALDRON. Then your theory is, that the tunnel will furnish all the water required for concentrating, but not for power?

Mr. SUTRO. Yes, sir. We mean to use coal or wood (e) for generating power, and we can mill for \$5 a ton by steam power where they are paying \$12 a ton now. We can get coal there, by constructing 35 miles of railroad, at \$12 a ton. (f) So that all the elaborate testimony in regard to that dam, and the removal of the present mills on the river, amounts to nothing. We do not want any dam. We do not require any dam there. We do not interfere with other people's mills. We do not have any interference in any shape at all.

We can pay 65 per cent. for the ore at the mine, without any charge for milling whatever; (g) for we can go to work and take out 90 per cent. of the ore at the mouth of the tunnel, using the water it furnishes, and driving our mills by steam power. That would make a clear saving to the mining companies of \$12 on each ton, or \$12,000 per day, or \$4,380,000 per annum; and, deducting the only expense they would be under—that is, the royalty—it would still leave them a clear saving of \$3,680,000 per year. (h)

EXPLORATION OF THE COUNTRY.

Another important consideration in the construction of the tunnel is the exploration of the country through which it will pass. It will cut a number of lodes nearly at right an-

(a) See Test., pp. 154, 156, 383, 384.

(b) See Test., pp. 155, 156, 157.

(c) See Test., p. 630.

(d) See Test., p. 769.

(e) See Test., pp. 187, 188, 189.

(f) See Test., pp. 630, 670, 713, 773, 774, 775.

(g) See Test., pp. 633, 634, 710, 712.

(h) See Test., pp. 634, 711.

gles before it reaches the Comstock lode, (a) as we find it stated in the commissioner's report. That these veins of ore are of considerable value they do not doubt. They contain immense masses of low-grade ores, which can be reduced at the mouth of the tunnel with advantage and profit, and will largely increase the production of bullion in that section. As a question of science, as a question of geology, of cutting at that depth through a section of country composed of volcanic rocks of three different geological ages, it is of the highest value. Our knowledge of geology is largely derived from superficial observations, and is to a great extent supposititious. Here we make an exact examination of the geological formation of that mountain, going through it at right angles, which will be of immense value geologically, and contribute largely to our knowledge on the subject.

WATER-PRESSURE ENGINES. (b)

To recur now to the value of this tunnel, as far as mining is concerned, it gives us a new basis of operations 2,000 feet below the present surface of much greater advantage than exists commencing at the original surface. (c) In this connection I must refer to this question of water again, and will state that this very water that is found to exist in those mines, which gives so much trouble to get out, can be collected within the mines; and since a large amount of that occurs within the first 500 or 600 feet from the surface, (d) it can be carried down in pipes to the tunnel level, 1,000 or 1,500 feet below the point where it is collected, which gives a column of water capable of operating a vast amount of machinery by means of water-pressure or other hydraulic engines. We have the evidence here that we get 1,400 horse power, and in that way we get power to go down below the tunnel level at least 2,000 feet, or 4,000 feet from the surface.

(a) See Test., p. 651.

(b) See Test., pp. 215, 216, 217, 218, 389, 390, 458, 459, 618, 649, 696.

(c) See Test., pp. 216, 217, 218, 219, 449, 450, 618, 676, 698, 699.

(d) See Test., p. 216.

WE WILL REACH GREATER DEPTH THAN HAS EVER BEEN REACHED
BEFORE.

We turn this very water, which is now of immense trouble in the mines, to account; we utilize it to go down below the tunnel level. Now, what do we attain? Why, we get down below the tunnel level 2,000 or 3,000 feet. It allows us to go down into the bowels of the earth 5,000 feet, while the deepest hole dug by man since the world has existed is only 2,700 feet deep; (a) and it remains for the youngest nation on earth to contribute more to science and geology, by giving opportunities of studying the formation of mineral veins at greater depth, than has ever been accomplished by any other nation in the world. We reach down a mile into the earth. If we show practically what scientific men theoretically know to be the case, that these veins reach down indefinitely, it will give a value to our mineral lands which we cannot compute. It is beyond all calculation, the increased value it will give to our mineral domain. It will give confidence to people. It will give confidence in mining operations. I have already shown what an immense saving the tunnel will make in all these different manipulations of mining. It will make a great highway under the mountain. It will be a little underground world by itself in the course of time. We are asking aid from the Government now to help us make four miles of that tunnel, which will result in 200 miles of tunnel. After that four miles is completed, we have a main artery, as it were, and we can spread out and drift under that mountain, and open up new avenues of exploration everywhere. We shall have streets and avenues beneath that mountain. We may employ 20,000 people then. All the capital required will be bone and sinew. (b)

General BANKS. Is that on one lode?

Mr. SUTRO. On that and others. There will be ramifications of drifts on that lode and also on other lodes under

(a) See Test., p. 312.

(b) See Test., pp. 213, 371, 373.

that mountain, (a) and it will take hundreds of miles of streets and avenues to reach them all.

General BANKS. You will want no further aid from the Government at all?

Mr. SUTRO. No further aid at all.

General BANKS. Why will you not want more aid?

Mr. SUTRO. Because, after we make that four miles of tunnel we reach the mines, and have an income then that will make it self-sustaining, and we can run drifts in every direction, and the loan we ask from the Government will be repaid in two or three years after the main tunnel is completed. We shall continue running these tunnels and drifts all under that mountain in every direction. There can be no question about it.

IMMENSE SAVING TO THE MINING COMPANIES.

The royalty these people will pay, which is a perfect trifle to them compared to the benefits they derive, will yield us a large revenue. We have shown here in this testimony, by several of the witnesses, that not over $\frac{1}{8}$ (one witness said only $\frac{1}{9}$) (b) of the mines are producing, and only $\frac{1}{9}$, therefore, will have to pay any royalty to the tunnel. (c) The others will get the benefit for nothing, though their mines will be drained and ventilated. We do not ask a single cent of contribution to the tunnel company until a mine finds ore and is able to pay. Probably only $\frac{1}{10}$ of what they save will be contributed to the tunnel company; (d) and that is under the contracts and under the law of Congress. Here is where the commissioners have made their mistake. They give a statement of the cost, which does not make a fair comparison; they have left out the most important facts. (e) What they do state they give upon the basis of what these superintendents fur-

(a) See Test., p. 734.

(b) See Test., pp. 367, 368.

(c) See Test., pp. 40, 41, 44, 45, 46, 47, 48, 213, 224, 225, 226, 362, 363, 364, 365, 369, 371, 556.

(d) See Test., pp. 159, 203, 204, 225, 226.

(e) See Test., pp. 209, 227.

nish them; the people who are the enemies of this great work, and whose only aim is to break it up if they can, and get hold of it themselves. Now, I want to give a few figures to show the difference between the statements which the commissioners have furnished and those which have been elicited by the testimony. I will show how entirely wrong and incomplete these statements are. According to the commissioners' estimate it would cost about as much to work by the tunnel, and according to one of their calculations would cost more, than what it costs by the present method. I have taken their figures as far as given, for it is quite unnecessary to question them in this calculation. I have simply added what they left out; what they did not bring into account; and they are the most important items. But these figures will tell their own story; they cannot be doubted, for they are based upon the testimony furnished by the commissioners themselves upon their examination, and that of other witnesses.

I will now read this comparative statement, which most conclusively shows an annual saving by the mining companies of \$9,891,151, after paying the royalty and all other expenses.

FAIR COMPARATIVE STATEMENT.

Cost of working by the present method. Taking the commissioners' figures, (a) and adding what they left out.

Hoisting 365,600 tons of pay ore, at 0.51.19 cents-----	\$187,077
Transportation of same to mills, at \$1.50-----	548,400
Pumping for last year (commissioners' estimate)-----	124,674
Hoisting and lowering 3,000 miners, at 8 cents each way, 16 cents-----	175,000
<i>To this should be added:</i>	
Hoisting 365,000 tons waste rock, at \$2 (b)-----	731,200

(a) See Commissioners' Report, p. 9.

(b) See Test., pp. 8, 9, 10, 11, 12, 13, 209, 465, 466.

Indirect cost of pumping at the 16 mines now being worked, including wear of machinery and additions, \$3,000 per month-----	\$456,000
Wages of 3,000 miners, at \$4 per day, \$12,000 (a)-----	4,380,000
Consumption of timber, 16,000,000 feet per annum, \$25 (b)-----	400,000
Cost of milling 365,000 tons of ore, \$10.50 (c)-----	3,838,800
Loss by present method of reduction, 35 per cent. on \$23,000,000, assay value (d)-----	8,050,000
Total -----	\$18,891,151

Cost of working by the Sutro tunnel. Taking the commissioners' figures, (e) and adding what they left out.

Lowering 365,600 tons pay ore, at 10 cents---	\$36,560
Transportation of same, average of 5 miles, 50 cents-----	182,800
Transportation of 3,000 miners, at 20 cents, \$600 per day-----	210,000
Royalty on 365,000 tons, at \$2-----	731,000

To this should be added:

Lowering 365,600 tons waste, at 10 cents (f)--	36,560
Transportation of the same, 5 miles, 50 cents (g)-----	182,800
Wages 2,250 miners, at \$4=\$9,000 per day--- (N. B. 2,250 miners, with the thermometer at 70°, will do as much work as 3,000 at 90°. Capacity increased 25 per cent.) (h)	3,285,000
Consumption of timber per annum, 8,000,000	

(a) See Test., pp. 72, 74, 172, 173, 392, 393, 394, 395, 627, 699, 700, 703, 704.

(b) See Test., pp. 37, 38, 70, 71, 369.

(c) See Test., pp. 58, 157, 158.

(d) See Test., pp. 159, 160, 256, 311, 354, 630, 631, 632, 706, 707, 708, 754.

(e) See Commissioners' Report, p. 10.

(f) See Test., pp. 20, 24, 25, 202, 620, 621, 622.

(g) See Test., pp. 20, 21, 22, 24, 26, 202, 457, 458, 663, 704, 705.

(h) See Test., pp. 72, 74, 172, 173, 392, 393, 394, 395, 627, 699, 700, 703, 704.

feet, \$25, (8,000,000 saved by good ventilation (a)-----	\$200,000
Cost of <i>milling</i> at mouth of tunnel 365,600 tons, at \$5 (b)-----	1,828,000
<i>Loss</i> at mouth of tunnel in reducing and concentrating ores, 10 per cent. on \$23,000,000. (Assay value.) (c)-----	2,300,000
Cost of concentrating, 365,600, at 75 cents (d)-----	274,200
Cost of roasting and working concentrations, 36,560 tons, at \$8 (e)-----	232,480
	<hr/>
Annual saving by means of the tunnel, after paying royalty and all other expenses-----	9,391,751
	<hr/>
	\$18,891,151

That is a fair comparison. The commissioners say it will cost more to work by the proposed method. What I have stated here is taken from the testimony. That is clear; and when the people out there say they are fighting against this royalty to the tunnel company, they do not give their true motives, for they still save over \$9,000,000 per annum. It is the Bank of California that opposes us, because if we get mills at the mouth of the tunnel they cannot get the tailings they keep now, and these enormous charges for reducing the ore. It is the Bank of California and its satellites, I repeat, who are fighting this great enterprise. (f) Any one who examines my statement will see I am correct; common sense will teach us that it is so.

THE SUTRO TUNNEL COMPANY.

But I will drop these figures now, and leave them to the examination of thinking men. Mr. Sunderland has made

(a) See Test., pp. 37, 38, 70, 71, 369.

(b) See Test., pp. 157, 158, 159, 634, 711, 712, 769.

(c) See Test., pp. 161, 628, 708, 709.

(d) See Test., p. 769.

(e) See Test., p. 736.

(f) See Test., pp. 164, 165, 177, 355, 356.

a motion to admit Mr. Foster's statement in relation to the Sutro Tunnel Company. We never objected to its admission at all. General Foster came back here at the request of the attorney of the Bank of California from New York voluntarily, without any orders from the Secretary of War, or any of his superior officers, to testify a second time; and he had a paper which he would not show to anybody. We learned it was a statement in relation to the Sutro Tunnel Company. It is stated that our stock is unassessable. I have said in the course of my remarks that these mining companies levy assessments on their stock, and make the holders pay up for what is spent in milling and other manipulations. We did not want to start out on any such basis. We wanted to protect the miners and laboring men who put their money in the company. We put our stock at \$10 a share, so that these men should have a chance to buy it; and made it unassessable, so they should not be "froze out," as this game is called. The attorney of the Bank of California finds fault with this arrangement, which is intended to protect all the stockholders. Then he states that \$7,000,000 of stock have already been disposed of, whereas only \$5,000,000 remained last year in the hands of the company. Why, gentlemen, this California Bank has been fighting us for six years in this enterprise. We had to dispose of our stock at a sacrifice. It is the history of every large undertaking. It is the history of every railroad company that a part of its stock has gone at low prices in order to interest capitalists. We have gone through immense difficulties, and in getting the first money we had to sell at a very low price; yet Mr. Sunderland makes out that this is a very bad condition of affairs. I think it is quite a natural condition of affairs. I have stated already that we have \$1,450,000 secured, and we do not owe a single dollar. I think that is doing very well indeed. We are giving this to the Government as security. Our means were limited. These men would not permit us to raise money. They wanted to break us up. Now they turn round and charge us with poverty;

after keeping us as poor as it was in their power to keep us, they charge us with not having spent a sufficient amount of money heretofore. But we are spending a great deal of money now, as is shown by a report published a few days ago by me as superintendent of the works. It is a report embracing the three months just past, and gives the figures as taken from the books of the company.

THE REPORT SAYS:

You will perceive by the annexed statements that the expenditures were—

For the month of December, 1871.....	\$28,821 04
For the month of January, 1872.....	43,517 40
For the month of February, 1872.....	50,490 41

Or a total for the three months of.....	\$122,828 85
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This does not include any expenditures incurred by the San Francisco office.

In December last work was commenced on all four of our shafts, and the same has been prosecuted since with due energy by day and night. On the 24th of this month the progress at the different points was as follows:

Length of tunnel.....	2,801 feet.
Depth of shaft No. 1.....	120 "
Depth of shaft No. 2.....	282 "
Depth of shaft No. 3.....	147 "
Depth of shaft No. 4.....	120 "

The slow progress of shafts Nos. 1 and 4 is accounted for by the fact that a considerable quantity of water has been encountered, and that the pumping machinery was delayed on the road. Shaft No. 2, in which the quantity of water was small, has been progressing steadily ever since its first commencement.

In December last a contract was made with the Diamond Drill Company for the use of diamond drills in all portions of the works. One of these drills has arrived at the tunnel, and experiments are being made for the purpose of ascertaining the best mode of employing it. With these drills it is confidently expected that the monthly advance in the tunnel will be 250 feet, and that of the shafts 150 feet. We may therefore look for a more rapid progress as soon as these are in full operation, which we hope will be the case by June next. (a)

Temporary steam engines and buildings have been erected on all the shafts; also extra boilers and steam pumps have been placed in operation, all of sufficient capacity to reach a depth of 500 to 800 feet. After that depth is reached machinery of much larger dimensions will be required, both for hoisting and pumping.

We have received estimates for the hoisting machinery from four of the machine works at San Francisco, the lowest bid amounting to \$65,000. The cost of transportation and erection, including buildings, will probably amount to a similar sum.

No specifications for large pumping machinery have as yet been submitted. They will be made out shortly, and bids, based upon them, invited from the foundries. A rough estimate of its cost, and placing the same in running order,

(a) See Test., pp. 314, 315, 316, 317, 318, 319, 320, 328, 626, 627.

may be given at \$200,000. All this heavy machinery should be contracted for within the next sixty days, since it will require at least four months to construct and erect the same, it being highly desirable for the rapid prosecution of the work that no delay should occur on that account.

The necessary tools for a first-class machine shop at the mouth of the tunnel—such as lathes, planing machines, drills, &c.—have arrived, and a suitable building and steam engine have been erected.

We have almost completed an excellent wagon road, commencing at the mouth of the tunnel, leading over the first summit, at an elevation of 1,350 feet, to shaft No. 2, situated in a ravine just beyond. From that point an old road to Virginia City has been placed in repair.

The poles for a telegraph line from Dayton to the mouth of the tunnel, and from thence to the four shafts and Virginia City, have been placed in position, and instruments at seven different stations will be in operation before long.

We have erected commodious boarding and lodging houses for the accommodation of the men at each of the four shafts; also a new one of much larger dimensions at the mouth of the tunnel.

The number of men employed was:

During December	159 men.
During January	231 "
During February.....	326 "

I have since received the accounts for March. The expenses for that month were \$47,589 94, and the progress at the different points was as follows:

Length of tunnel.....	2,852 feet.
Depth of shaft No. 1.....	165 "
" " " " 2.....	384 "
" " " " 3.....	210 "
" " " " 4.....	200 "

Mr. Sunderland has informed us here that the Bank of California is not a stock-jobbing concern; but that the Suto Tunnel Company is, because we have not made our shares assessable. I do not see the philosophy of that. If you have stock that is assessable, you can break it down or put it up, according to the assessments which are levied. If they are unassessable, you cannot do that; they have a certain given value. Mr. Sunderland, furthermore, goes on to say that we started seven years ago, when these contracts were made six years ago; and that they refused to put in any money in New York and California for a long time. Why, that is nothing to be wondered at. The machinations of the Bank of California were going on all this time, and they determined to stop us; and now they have the assurance to charge us with not raising money any sooner, when it is a known fact they repudiated all subscriptions.

HISTORICAL OPPOSITION TO GREAT IMPROVEMENTS.

It is, however, a historical fact, that there has been opposition to all kinds of improvements either by the ignorant; the envious, or by those who were interested in keeping up the old state of affairs, since the world began. If you even look back to the great mechanical improvements that have been made, the introduction of the spinning jenny, and even that of sewing machines, you will find there was opposition. Every sewing girl in the country opposed sewing machines. They thought their occupation would be gone. We find many curious things related in history. Take Galileo, when he announced the discovery of a new planet. They scouted the idea. There had only been seven planets known before that; and the whole of Italy stood up in perfect horror. They preached against him from the pulpit everywhere, and the argument used against his discovery was, that it was impossible that there should be more than seven planets, because there were no more than seven days in a week, and no more than seven openings in a man's skull. That is the kind of argument they used, and some as unreasonable have been used against many new ideas. Look at the arguments used against the first railroad in England. They were of the most extraordinary and unreasonable kind. It makes us smile to read them now. There are many points resembling this fight against the tunnel. If you substitute the Bank of California for the Duke of Bridgewater, and Mr. Sharon for Mr. Bradshaw, you have a perfectly parallel case. But I will read:

THE LIVERPOOL AND MANCHESTER RAILWAY. (a)

The rapid growth of the trade and manufactures of South Lancashire gave rise, about the year 1821, to the project of tramroad for the conveyance of goods between Liverpool and Manchester. Since the construction of the Bridgewater canal by Brindley, some fifty years before, the increase of the business transacted between the two towns had become quite marvelous. The steam engine, the spinning jenny, and the canal, working together, had

(a) See "Lives of the Engineers," by Sam. Smiles, vol. III. London, 1862.

accumulated at one focus a vast aggregate of population, manufactures, and trade.

The Duke's canal, when first made, furnished a cheap and ready means of conveyance between the seaport and the manufacturing towns, but had now become entirely inadequate. Mr. Huskisson, in the House of Commons, referring to the ruinous delays occasioned, observed that cotton was sometimes delayed a fortnight at Liverpool, while the Manchester manufacturers were obliged to suspend their labors.

Expostulation with the canal companies was of no use. They were overcrowded with business at their *own* prices, and disposed to be very *dictatorial*.

Under these circumstances any new mode of transit between the two towns, which offered a reasonable prospect of relief, was certain to receive a cordial welcome. Mr. Sanders, an influential Liverpool merchant, was among the first to advocate a tramroad. Having caused inquiry to be made as to the success which had attended the haulage of heavy coal trains by locomotive power, he was led to form the opinion that the same means might be employed in the transportation of merchandize. He ventilated the subject among his friends, and about the beginning of 1821 a committee was formed for the purpose of bringing the scheme of a railroad before the public.

The novel project, having become noised abroad, attracted the attention of the friends of railways in other quarters. Sir Richard Phillips, in his "Morning Walk to Kew," already said, in 1813: "I found delight in witnessing at Wandsworth the economy of horse labor on the iron railway. Yet a heavy sigh escaped me as I thought of the inconceivable millions of money which had been spent about Malta, four or five of which might have been the means of extending double-line railways from London to many parts of England. Such would have been a legitimate motive for *overstepping the income of a nation*, and the completion of so great and useful a work would have afforded national ground for public triumph or general jubilee."

Thomas Gray, of Nottingham, was another speculator on the same subject. Though he was no mechanic or inventor, he had an enthusiastic belief in the railroad system. It would appear that Gray was residing in Brussels, in 1816, when the project of a canal from Charleroi was the subject of discussion, and in conversation with Mr. John Cockerill and others, he took advantage of advocating the superior advantages of railways. He occupied himself for sometime with the preparation of a pamphlet on the subject. He shut himself up in his room, secluded from his wife and relations, declining to give them any information on the subject of his mysterious studies, beyond the assurance that his scheme "would revolutionize the whole face of the material world and society."

In 1820 Mr. Gray published the result of his studies in his "Observations on a General Iron Railway."

The publication of this essay had the effect of bringing the subject of railways prominently under the notice of the public. Although little able to afford it, Gray also pressed his favorite project on the attention of public men: mayors, members of Parliament, and prime ministers. He sent memorials to Lord Sidmouth in 1820, and to the Lord Mayor and corporation of London in 1821. In 1822 he addressed the Earl of Liverpool, Sir Robert Peel, and others, urging *the great national importance* of his plan. In the year following he petitioned the ministers of state to the same effect. He was so pertinacious that public men pronounced him to be a "bore;" and in the town of Nottingham, where he then lived, those who knew him declared him to be "cracked." William Howitt, who frequently met Gray at that time, has published a long portraiture of this indefatigable and enthusiastic projector; who seized all men by the button, and would not let them go until he had unraveled to them his wonderful scheme. With Thomas Gray, says he, "begin where you would, on whatever subject—the weather, the news, the political movement or event of the day—it would not be many minutes before you

would be enveloped with steam, and listening to a harangue on the practicability and immense advantages to the nation, and to every man in it, of a general iron railway."

These speculations show that the subject of railways was gradually becoming familiar to the public mind, and that thoughtful men were anticipating with confidence the adoption of steam power for railway traction. At the same time a still more profitable class of laborers was at work: first, men like Stephenson, who were engaged in improving the locomotive; and, next, those like Edward Pease, of Darlington, and Joseph Sandars, of Liverpool, who were organizing the means of laying down the railways.

In 1821 Mr. Sandars authorized Mr. William James, of Bromwich, to survey the proposed railway line between Liverpool and Manchester, and agreed to pay him for the survey at the rate of £10 per mile, or £300 for the survey.

The trial survey was then proceeded with, but it was conducted with great difficulty, the inhabitants of the district entertaining the most violent prejudices against the formation of the proposed railway. In some places Mr. James and his surveying party even encountered personal violence. Near Newton-in-the-Willows, the farmers stationed men at the field gates, with pitchforks and sometimes with guns, to drive them off. A number of men, women, and children collected and ran after the surveyors, bawling nicknames and throwing stones at them.

Mr. Sandars had by this time visited George Stephenson at Killingworth, and was charmed with him at first sight. The energy which he had displayed in carrying on the works of the Stockton and Darlington railway, his readiness to face difficulties, and his practical ability in overcoming them; the enthusiasm which he displayed on the subject of railways and railway locomotion concurred in satisfying Mr. Sandars that he was, of all men, the best calculated to help forward the Liverpool undertaking at this juncture.

On his return he stated this opinion to the committee, and George Stephenson was unanimously appointed engineer of the projected railway.

A public meeting was held to consider the best plan to be adopted, and a committee was appointed to take the necessary measures for the construction of the road. Before entering upon their arduous duties they first waited on Mr. Bradshaw, the Duke of Bridgewater's canal agent, in the hope of persuading him to increase the means of conveyance, as well as to reduce the charges; but they were met with an unqualified refusal. They suggested the expediency of a railway, and invited Mr. Bradshaw to become a proprietor of shares in it. But his reply was, "All or none." The canal proprietors, confident in their imagined security, ridiculed the proposed railway as a chimera. *It had been spoken about years before*, and nothing had come of it then. It would be the same now.

In the meantime the survey was proceeded with, in the face of the great opposition on the part of the proprietors of the lands through which the railway was intended to pass. The prejudices of the farming and laboring classes were strongly excited against the persons employed upon the ground, and it was with the greatest difficulty that the levels could be taken.

When the canal companies found that the Liverpool merchants were determined to proceed with their scheme—that they had completed their survey, and were ready to apply to Parliament for an act to enable them to form the railway—they *at last reluctantly, and with bad grace, made overtures of conciliation*. The promised to supply steam vessels, both on the Mersey and the canal. At the same time they made a show of lowering their rates. *But it was all too late*; for the project of the railway had now gone so far that the promoters (who might have been conciliated at an earlier period) felt they were very fully committed to it, and now they could not very well draw back. Arrangements were therefore made for proceeding with the bill in the parliamentary session of 1825.

On this becoming known, the canal companies prepared *to resist the measure tooth and nail*. The public were appealed to on the subject; pamphlets

were written, and newspapers were hired to resist the railway. It was declared that its formation would prevent cows grazing and hens laying. The poisoned air from the locomotives would kill birds as they flew over them, and render the preservation of pheasants and foxes no longer possible. Householders adjoining the projected line were told that their houses would be burnt up, while the air around would be polluted by clouds of smoke. There would no longer be any use for horses, and if railways extended the species would become extinguished, and oats and hay be rendered unsaleable commodities.

A Birmingham journal invited a combined opposition to the measure, and a public subscription was entered into for the purpose of making it effectual. The newspapers generally spoke of the project as a mere speculation, some wishing it success, although greatly doubting, others ridiculing it as a delusion, similar to the many other absurd projects of that madly speculative period. The idea thrown out by Mr. Stephenson, of traveling at a rate of speed double that of the fastest mail coach, appeared at the time so preposterous, that he was unable to find an engineer who would risk his reputation in supporting such "absurd views." Speaking of his isolation at the time, he subsequently observed that he had then no one to tell his tale to but Mr. Sanders, of Liverpool, who did listen to him, and kept his spirits up; and his schemes were at length carried out only by dint of sheer perseverance.

George Stephenson's idea was at that time regarded as but a dream of a chimerical projector. It stood before the public friendless, struggling hard to gain a footing, and scarcely daring to lift itself into notoriety, for fear of ridicule; and when no leading man of the day could be found to stand forward in support of the Killingworth mechanic, its chances of success must indeed have been pronounced but small.

Parliamentary contest on the Liverpool and Manchester bill.

The Liverpool and Manchester bill went into Committee of the House of Commons on the 21st of March, 1825. There was an extraordinary array of legal talent on the occasion, but especially on the side of the opponents to the measure. Their wealth and influence enabled them to retain the ablest counsel at the bar.

Evidence was taken at great length as to the difficulties and delays of forwarding goods from Liverpool to Manchester, the utter inadequacy of the existing modes of conveyance, and as to the practicability of a railroad worked by locomotive power. Mr. Adams, in his opening speech, referred to the cases of the Hilton and Killingworth railway, where heavy goods were safely and economically transported by means of locomotive engines. "None of the tremendous consequences," he observed, "have ensued from the use of steam in land carriage that have been stated. The horses have not started, nor the cows ceased to give their milk, nor have ladies miscarried at the sight of these things going forward at the rate of four miles and a half an hour."

Mr. Stephenson stood before the committee to prove what the public opinion of the day held to be impossible. The self-taught mechanic had to demonstrate the practicability of that which the most distinguished engineers of the time regarded as impracticable. Clear though the subject was to himself, and familiar as he was with the powers of the locomotive, it was no easy task to bring home his convictions, or even to convey his meaning, to the less informed minds of his hearers. In his strong Northumbrian dialect he struggled for utterance, in the face of the sneers, interruptions, and ridicule of the opponents of the measure, and even of the committee, some of whom shook their heads and whispered doubts as to his sanity when he energetically avowed that he could make the locomotive go at the rate of twelve miles an hour.

One of the members of the committee pressed the witness a little further, and put the following case: "Suppose, now, one of these engines to be going along a railroad at the rate of nine or ten miles an hour, and that a cow were to stray upon the line: would not that, think you, be a very awkward circum-

stance?" "Yes," replied the witness, with a twinkle in his eye, "very awkward—for the coo."

After some distinguished engineers had been examined, Mr. Alderson summed up in a speech which extended over two days. He declared Mr. Stephenson's plan to be "the most absurd scheme that ever entered into the head of a man to conceive. My learned friends," said he, "almost endeavored to stop my examination; they wished me to put in the plan, but I had rather have the exhibition of Mr. Stephenson in that box. I say he never had a plan—I believe he never had one—I do not believe he is capable of making one."

Mr. Harrison, in summing up the case of the canal companies, said: "At length we have come to this: having first set out at twelve miles an hour, the speed of these locomotives is reduced to six, and now comes down to two or two and a half. They must be content to be pulled along by horses and donkeys, and all those fine promises of galloping along at the rate of twelve miles an hour are melted down to a total failure."

After further personal abuse of Mr. Stephenson, whose evidence he spoke of as "trash and confusion," he closed the case of the canal companies on the 3d of May. Mr. Adams replied for the promoters, vindicating Mr. Stephenson and the evidence which he had given before the committee.

The committee then divided on the preamble, which was carried by a majority of only one. The clauses were next considered, and, on a division, the first clause, empowering the company to make a railway, was lost; also the next clause, empowering the company to take land.

Thus ended this memorable contest, which had extended over two months; carried on throughout with great pertinacity and skill, especially on the part of the opposition, who left no stone unturned to defeat the measure.

The result of this first application to Parliament was so far discouraging. Mr. Stephenson had been so terribly abused by the leading counsel for the opposition, stigmatized by them as an ignoramus, a fool, and a maniac, that even his friends seem for a time to have lost faith in him and his locomotive system, whose efficacy he nevertheless continued to uphold. Things never looked blacker for the success of the railway system than at the close of this great parliamentary struggle, and yet it was on the very eve of its triumph.

The Committee of Directors, appointed to watch the measure in Parliament, determined at once to make a new survey, and not to employ Mr. Stephenson for the purpose. The survey was completed, and the bill again went before Parliament. It went before the committee on the 6th of March, and on the 16th the preamble was declared proved. On the third reading in the House of Commons an animated debate took place, and the bill carried; it almost unanimously passed the House of Lords.

Mr. Stephenson was now elected principal engineer of the road, and to his skill and intelligence were mainly due its early and satisfactory completion.

THE BANK OF CALIFORNIA AND THE DUKE OF BRIDGEWATER.

We might search through history and not find a more parallel case than the one I have just quoted. As I have stated, all we have to do is to substitute the Bank of California for the Duke of Bridgewater and the name of Sharon for that of Bradshaw, and the parallel is perfect. The Duke of Bridgewater, with an army of attorneys, went to Parliament and presented his budget of objections. We find the Bank of California present here in Congress

with theirs. (a) Look at the testimony which has been taken in this case, and see how absurd some of the objections raised must appear to you; in ten years from now the parties making them will be ashamed of ever having occupied such a position.

They have come here to prove that it is cheaper to pump out water from a depth of 2,000 feet than to let it flow out by itself. They would have you believe that white is black, or that water will flow up hill of its own accord.

It took years of persistent efforts to succeed with the first railroad against the machinations of its enemies. I have been for years trying to sustain myself against the unscrupulous influence of the Bank of California, and am proud to say we are now on the full road to success, thanks to the noble-hearted friends I have found in and out of Congress. Mr. Stephenson found one sterling, unflinching friend to stand by him, and that was Mr. Joseph Sandars, of Liverpool; and I want to pay tribute right here to a noble-hearted, far-seeing, generous, and true man, who has stood by me in the darkest hours of my trials, who has counseled and assisted me at all times, who has appreciated the magnitude and importance of the work to which I have devoted myself. That man's name is Joseph Aron, a resident of San Francisco.

I have recited the objections which were raised against the first railroad not quite fifty years ago. That road was built, notwithstanding the bitter and persistent opposition of the Duke of Bridgewater, who considered himself aggrieved and injured in his canal property should the road be constructed. And what was the result? The developments and industry created by the new facilities for traffic were so great, that the canal property became more valuable than ever, and the example set immediately created a perfect furor for building railroads, not only in England, but all over the world. To the success of this first railroad was due the construction of railroads in every country on the

(a) See Test., p. 16.

globe. The public, which is skeptical and unbelieving, only needed one single practical illustration of success. The moment that was achieved opposition to railroads ceased to exist.

A THOUSAND TUNNELS IN THIS COUNTRY.

Let this *one* tunnel be constructed, and the magnificent results become known which will flow from it, it will result in the construction of a thousand more (*a*) by private enterprise throughout our vast mining regions. (*b*) A new system of mining and reduction will be inaugurated, and the necessary capital will flow in that direction without any further effort. (*c*) The magnificent inheritance of our mineral domain will commence to be fully appreciated; that great treasure chest, which Providence has given us, will be unlocked; the nation will be enriched; (*d*) trade and traffic will receive an impetus unknown heretofore; and our national debt will sink into insignificance compared to the wealth this country will then be known to possess.

The treasure contained in this Comstock lode alone is beyond computation; the developments made within the last twelve months, at the greatest depth which has yet been reached—1,500 feet beneath the surface (*e*)—has convinced the most incredulous. It is sufficient to stagger the mind when contemplating what treasure will be developed at a depth of 4,000 or 5,000 feet, which can be reached by means of this tunnel.

DUTY OF THE GOVERNMENT.

As far as the duty of the Government is concerned, it is very plain. There can be no question that these mines on the Comstock lode are the most important in the whole world, and I do not believe that any other nation ever possessed a

(*a*) See Test., pp. 210, 211, 220, 302, 615, 616.

(*b*) See Test., pp. 599, 600.

(*c*) See Test., pp. 210, 220, 302, 313, 601, 615, 616, 637, 638, 657, 668.

(*d*) See Test., pp. 221, 295.

(*e*) See Test., pp. 220, 286, 303, 640, 684.

series of mines as valuable as these are. (a) Any nation on the globe would be proud to possess such a property within the boundaries of its country. If we inquire as to the motives of Napoleon in sending an expedition of conquest to Mexico, we find that he was anxious to secure the mineral products of that country. We have in Nevada a single vein of ore almost as important as all the mineral wealth of Mexico. These mines are now worked for stock-jobbing purposes, and are the worst managed property on the face of the globe. (b) Having mines of that importance, it is to the interest of the Government to have that state of affairs cease to exist. They are worked in the most extravagant manner. (c) The precious metals are wasted, and they furnish the worst kind of an example for other mines. They discourage the people from going into mining operations; and what we want is capital to flow into that western country. As long as we have no capital flowing there we cannot open up our mineral wealth. We have authentic accounts that those mines have yielded \$125,000,000, and that they are now yielding \$15,000,000 a year; and I mean to say that if the tunnel was in, the yield would be increased to from \$30,000,000 to \$50,000,000 per annum.

Scientific men may say what they please about the continuance of mineral veins in depth; it has no effect. I have been for six or seven years in contact with financial men, and they do not believe in any theories. In the first place, they are too unscientific as a class to understand geological evidences and deductions; and, in the second place, they are too much occupied to bother themselves about it. They can make money easy enough without making such investigations, and they will not trouble themselves about it. But if you demonstrate it practically that these mines reach down, and that they can be worked profitably, to great depth, money will flow in that direction of its own accord; (d)

(a) See Test., pp. 63, 207.

(c) See Test., pp. 212, 231, 663.

(b) See Test., pp. 301, 662, 663.

(d) See Test., pp. 210, 211, 214, 220, 684.

and, as I stated, thousands of tunnels will be made in our western hills; thousands of millions of taxable property will be created, and the increase of bullion will be immense. As regards political economy, I will not tire you out by quoting any authorities thereupon. You all know that it has an important bearing upon the payment of the national debt. (a) We have the authority of Chevalier, John Stuart Mill, Bowen, and others on that subject.

SECURITY TO THE GOVERNMENT.

As far as the security we offer is concerned, it is ample. We have asked that question of almost every witness we have had here, and they do not doubt it. They know this royalty alone will enable us to pay back the money loaned us. Professor Newcomb and Mr. Luckhardt say that it cannot be questioned; (b) and I venture to say that many times the amount could be returned, if it were required. All we ask is the good will of the Government to help us make the first four miles of this tunnel, and then we will make a hundred miles in addition. We do not ask any gift of the Government. We only ask for so much help to get this tunnel in. We give the Government the first mortgage on this property; and, as has been shown here by every witness, there is no question about the security at all. Even if there were not an abundance of ore below the tunnel level, the low-grade ores, which amount to hundreds of millions of dollars, which we shall be able to extract above the tunnel alone, will secure several times what we ask. (c) These people who oppose the tunnel say there is no necessity for any aid; that the land at the mouth of the tunnel will be worth \$3,000,000; (d) and that the income will be \$6,000,000 per annum. That is all very well to tell us; but we may not have a dollar of income until the tunnel is completed to the Comstock lode. If we have an in-

(a) See Test., pp. 313, 542.

(b) See Test., pp. 210, 211, 636, 672.

(c) See Test., pp. 19, 63, 151, 152, 205, 206, 267, 208, 398, 555, 684, 685, 733.

(d) See Test., p. 557.

come of from \$2,000,000 to \$6,000,000 per annum thereafter, we can pay that money back very soon. We are now at work on this tunnel. We are pushing it forward day and night. We have invested the limited capital we have, and are pushing it along, to show our own faith in the work. Now, the Government ought to step in and come to the rescue. Our money will probably be exhausted in another year from now, and the work may come to a stand-still.

Mr. Sunderland has criticized this bill. He says this bill is for Mr. Sutro, and that it does not mortgage all the property. Now, we ask you, gentlemen of the committee, to make that bill so perfect that there can be no doubt about the security given by a first mortgage. We want to mortgage to the Government the royalty we receive from these mines; and that royalty is as good security as the Government would ask; and we want to mortgage everything we have besides. According to the statements made, we have \$700,000 a year to receive from royalty, while these people are saving \$9,000,000 at the present capacity alone. If the yield is trebled, which it likely will be, why the income from that source will be \$2,100,000, and the saving to the mines \$27,000,000 per annum. We are asking for a loan here, and not for a gift. The Government will have entire control and revision of our accounts. Unless we make a correct report of the income, our rights are forfeited; and there are commissioners to be appointed under the law who make their reports to the Government.

THE BANK OF CALIFORNIA COMPOSED OF PATRIOTIC MEN.

Mr. Sunderland has told us that if the Government puts its money in, it ought to own the tunnel. It is not the policy of this Government to go itself into such enterprises; but it is the policy of the Government to foster great interests, and aid in the development of the country. The Government does not want to go into mining operations and own these works. The attorney of the Bank of California has told us that if we get this aid, our stock would go up to par, thus enabling us to fight them. He cannot

mean that we will fight them, but we will be able to take care of ourselves and resist their opposition; but if we do not get this aid, they can continue their fight and prevent us from obtaining the means to construct the tunnel, for they still cling fondly to the hope that they can delay us in obtaining the means, and thus possibly break us up yet. What interest have they in coming on here to Washington and opposing a loan to this work? Are they such patriotic men that they come here to advise the Government what to do? Why, the very fact that they have agents here to oppose us ought to help us. They have been trying to show all along that this tunnel is useless. They come here lobbying against us, and trying to upset this great work, in order to leave us to our fate. We have spent hundreds of thousands of dollars already, and we expect to expend \$1,000,000 before we will receive a dollar from the Government.

WILL CONGRESS ASSIST THE LABORING MEN.

Let us look at the other side of this question. Who are the people favoring this work? Why, the laboring men. Every one of these witnesses has shown that the laboring men and the Miners' Union are favoring it, (a) while the Bank of California is opposed to it. Now, I say, will the Government consider the interests of these laboring men? They have invested their savings in this tunnel; and while this Government has done much for great corporations, let it come forward now and assist these laboring men. (b) These working men are interested in this tunnel; hundreds, nay, thousands of them are now or will be. (c) They want to see this work carried out. They want to be relieved from the terrible doom they are condemned to in those mines, exposed to a heat of 110°, breathing air almost deprived of oxygen, which slowly kills them. We have had an instance at Gold Hill where *forty-two* miners were burned to death. (d)

(a) See Test., pp. 17, 166, 168, 208, 311, 355, 463, 464.

(b) See Test., pp. 186, 385, 386, 387, 395.

(c) See Test., p. 312.

(d) See Test., p. 465.

Every mine-owner ought to be compelled by law to construct shafts and outlets, and, if that tunnel goes in, we shall have an outlet for them; they will have a chance to escape.

Take the humanitarian view. These mine-owners ought to be compelled, everywhere throughout the United States—in Pennsylvania and all the other mining sections—to furnish outlets of escape. Good ventilation, besides giving an immense saving to the mine-owners, is a great relief to these poor men, and protects their health. These commissioners were not allowed to go into a single mine, as they have stated, but that they were accompanied by the superintendent; and they asked these miners how they felt, and they said “quite well,” yet these commissioners could not imagine how that could be when they felt so faint themselves. All the inquiries were made in the presence of these superintendents, and the miners did not tell what they desired to say for fear of being discharged. (a)

POLICY OF THE GOVERNMENT.

It has been the policy of this Government to aid great interests and foster science. We have had numerous exploring expeditions; extensive geological surveys; sent ships to the north pole; and sent an expedition into Brazil to explore for coal; have sent others to make astronomical observations. An appropriation just passed gives \$50,000 to observe the transit of Venus in three years from now. It has been the policy of this Government to foster science and the acquisition of knowledge. Here we have a work that will do more for science and geology than any investigation heretofore made, (b) and at the same time will directly add to the wealth of the nation. (c) Thousands of millions will be added to our wealth, and all this will be accomplished without the actual contribution of a single dollar by the Government. We are spending millions

(a) See Test., pp. 109, 166, 167, 168, 208. (b) See Test., pp. 65, 210.

(c) See Test., pp. 616, 617.

every year for commerce. Here is an interest as important as any we have in this country; and I mean to say that, in ten or twenty years from now, this mining interest will be almost the leading one in this country. (a)

The Government has done nothing for the mining interest as yet. We have paid our proportion of taxes in these mining regions. We have no manufactures to protect. We have no commerce, and no rivers and harbors to be improved. The mining regions have not received a dollar from the Government in any shape whatever. We have contributed more than \$3,000,000—yes, many times \$3,000,000—during our short existence, in paying towards the support of the manufacturing interests in the east. Now, what do we ask here for this mining interest? We ask simply a loan of \$3,000,000 in carrying out a work that will do more than anything else you could do to promote that interest.

I have hurried over the latter part of this subject somewhat, and still I have almost wearied you out. It is a vast one, and of great importance. It is one which you, gentlemen, living in this part of the country, hardly realize; but if once you travel over that immense country to the Pacific coast, you will be astonished. You may read descriptions, but without seeing for yourselves you cannot fully understand them. That vast area of country has been designated on the maps as the Great American Desert, but while the land there is almost unfit for agriculture, those mountains are perfect fountains of wealth, and I come to Congress and ask you to help us along against the overwhelming monopoly which is keeping our prosperity back, and which has been trying to crush us out for years. I believe that during all these struggles I have contributed somewhat to the knowledge of our vast mineral resources. I have published books, maps, and pamphlets, which have been seen and read by public men, and awakened an interest in the examination of this great subject of mining for the precious metals.

(a) See Test., p. 600.

Mr. Chairman and gentlemen of the committee, I will now close my remarks. I must have almost exhausted your patience in having you listen to me so long, though I am sure I have not done half justice to this great subject.

In closing, then, I want to call your attention to the fact once more, that this is not a gift, not a subsidy, not an absolute expenditure by the Government; but simply the extension of its good-will, the granting of a loan, with the most ample security, to assist in the execution of a work which must enhance the property value of this country to the extent of thousands of millions; and let me say to you, gentlemen, that you will point with a feeling of pride to the day when, by voice and vote, you assisted in the execution of a work which will hereafter be looked upon as a proud monument to the enterprise of the American people.

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REPORT OF THE COMMITTEE ON MINES AND MINING.

The Committee on Mines and Mining, to whom was referred H. R. 1173, entitled "A bill to aid in the construction of the Sutro tunnel from the proceeds of the sale of mineral lands," after careful consideration, have prepared the accompanying substitute, and recommend its passage:

Your committee have patiently and carefully investigated all the questions having any bearing upon the subject; they have heard the evidence of the commissioners and other experts; they have listened to the arguments for and against the bill; and, without commenting at length upon the details of their investigations, beg leave to submit the following statement of facts and conclusions:

1st. Our mineral domain is almost unlimited in extent, and of inestimable value.

2d. The mines on the Comstock lode are the most valuable in the world.

3d. They have yielded already \$130,000,000 in bullion.

4th. Their present annual yield exceeds \$15,000,000.

5th. Their future yield, by means of a deep tunnel, will be almost incalculable.

6th. Deep tunnels are necessary for the full development of our mining interests.

7th. The Sutro tunnel is of the highest importance to the future profitable working of the mines on the Comstock lode.

8th. The construction of this tunnel was authorized by the Legislature of Nevada.

9th. The mining companies on the Comstock lode contracted for its construction.

10th. The Legislature of Nevada memorialized Congress to aid in its construction.

11th. Congress, by special law, endowed it with certain rights and privileges.

12th. Congress reaffirmed those rights by a refusal to interfere with them.

13th. Congress again reaffirmed them by provisions in two general mining laws.

14th. Congress sent out a commission to report upon the facts concerning it.

15th. The commissioners made a report, recommending the work to favorable consideration.

16th. Some points in the report not being entirely clear, the commissioners were fully examined by your committee.

17th. Other witnesses, amongst whom Professor Raymond, the United States Commissioner on Mining, were also examined.

18th. The testimony (which accompanies this report, embracing 810 pages) makes a conclusive case in favor of the tunnel.

19th. The construction of the tunnel is entirely feasible.

20th. It will cost from \$4,000,000 to \$5,000,000.

21st. It will take from $2\frac{1}{2}$ to $3\frac{1}{2}$ years to complete it.

22d. It will be of immense benefit to the legitimate owners of the mines.

23d. It will secure the health of the miners by good ventilation.

24th. It will create an outlet for escape in case of fire.

25th. It will establish a new basis of operations 2,000 feet below the surface.

26th. It will drain the water to that depth by its own flow, and dispense with the numerous steam engines now required.

27th. The water contained in the mines may be utilized as a great water power to pump the water, by means thereof, from below the tunnel level.

28th. Greater depth may be reached thereby than has ever been reached before on any mines in the world.

29th. It will stimulate explorations on all portions of the Comstock lode, and may increase its yield to \$50,000,000 per annum.

30th. It will develop several lodes in the course of its construction.

31st. Immense quantities of low-grade ores exist in the Comstock lode and other lodes cut by the tunnel.

32d. These low-grade ores can only be utilized by means of concentrating works.

33d. Extraordinary facilities exist at the mouth of the tunnel for the erection of improved concentrating and reduction works.

34th. The tunnel itself will furnish sufficient water for concentrating and amalgamating purposes.

35th. Cheap motive power can be secured with coal from the Rocky Mountains and firewood floated down Carson river.

36th. As a geological survey, penetrating into this argenteriferous mountain, it will be of the highest value to science.

37th. It will serve as a pattern work for all the other mining districts.

38th. Its success will give confidence in mining operations.

39th. A practical illustration of the downward continuance of mineral lodes will give a high value to our mineral domain.

40th. It will make capital flow in that direction.

41st. It will result in the construction of hundreds of tunnels by private enterprise.

42d. It will populate our vast mining regions; and create millions of dollars of taxable property.

43d. It will establish a mart for western produce and eastern manufactures.

44th. The total yield of gold and silver will be largely increased.

45th. The increase of the stock of the precious metals has a tendency of increasing the money value of all property.

46th. That increased value relieves the burdens of the people by reducing the rate of taxation.

47th. It has a most important bearing on the payment of the national debt.

48th. The Sutro tunnel is now in full progress of construction.

49th. The company has secured funds to the amount of \$1,500,000, and is expending upon the work at the rate of \$50,000 per month.

50th. The work is of national importance, and the aid provided for in this bill will secure its early completion.

51st. The security to the Government is unquestionable, ample, and satisfactory: one half of the royalty alone yielding at the present rate of production \$365,000 per annum.

52d. Under the bill reported the aid extended shall not exceed \$2,000,000.

53d. The company is required to spend an equal amount to that loaned by the Government.

54th. One half of all the income will be paid over to the Government semi-annually.

55th. The sum loaned, together with interest, will probably be repaid to the Government within a few years after its completion.

56th. No money will be paid until the commissioners to be appointed shall report the completion of each section, as prescribed by law.

57th. A non-compliance with the provisions of this bill will forfeit all rights under the same.

58th. The aid extended only applies to the first four miles of tunnel to the Comstock lode.

59th. This first section of the tunnel will form, as it were, the main artery or highway, from which one hundred miles of branch tunnels may be constructed.

60th. No further aid will be required; for after the tunnel reaches the mines, the income will be sufficient to make it self-sustaining.

61st. We would in conclusion indorse the language used in the closing paragraph of a report to Congress made by a former committee, recommending a loan of \$5,000,000, in the following words:

"That taking into consideration the magnitude of the undertaking, the large yield of bullion which will be directly secured thereby, the great influ-

ence by its successful completion upon all our mining interests, the stimulus it will give to mining generally, the positive proof it will furnish of our immense mineral wealth, and considering the importance of attaining these results, in view of our large national debt, ordinary wisdom and foresight should command that the aid asked for the construction of this important work, or a much larger sum, if it were necessary, should be granted, even were no security whatever offered for its repayment."

For further and detailed information upon the subjects embraced in this report, your committee refers to—

1st. The act of the Nevada Legislature, entitled "An act granting the right of way, and authorizing A. Sutro and his associates to construct a mining and draining tunnel," approved February 4, 1865. (See book on Sutro Tunnel, p. 71.)

2d. The contracts with the mining companies. (See book on Sutro Tunnel, p. 173.)

3d. Law of Congress, entitled "An act granting the right of way and granting other privileges to aid in the construction of a draining and exploring tunnel to the Comstock lode in the State of Nevada," approved July 25, 1866. (See U. S. Statutes at Large, vol. 14, p. 242.)

4th. The Comstock Lode, its Character, &c. By Ferdinand Baron Richthofen, Dr. Phil, San Francisco: Towne & Bacon printers, 1866. (See Book on Sutro Tunnel, p. 95.)

5th. Joint memorial and resolutions by the Nevada Legislature, asking Government aid in the construction of the Sutro tunnel, 1867. (See book on Sutro Tunnel, p. 13.)

6th. Report to the Legislature by the Senate Committee on Federal Relations on the foregoing memorial, 1867. (See book on Sutro Tunnel, p. 77.)

7th. Resolutions by the Nevada Legislature, January, 1867. (See book on Sutro Tunnel, p. 92.)

8th. Report to the Mechanics' Institute of San Francisco by a special committee appointed to investigate the merits of the Sutro tunnel, April 4, 1867. (See book on Sutro Tunnel, p. 141.)

9th. Report on the Sutro tunnel by the Hon. Joseph S. Wilson, Commissioner of the General Land Office, Washington, June, 1868. (See Miscellaneous Documents No. 156, 40th Congress, 2d session.)

10th. Report of the Committee on Mines and Mining to the United States House of Representatives recommending an appropriation of \$5,000,000 by the Government. (Pub. Doc.; see Report No. 50, 40th Congress, 2d session.)

11th. Proceedings in the House of Representatives of the United States March 17, 22, and 23, 1870, and in the United States Senate April 27 and 28, 1870.

12th. "An act authorizing and requesting the President of the United States to appoint a commission to examine and report upon the Sutro tunnel," approved April 4, 1871.

13th. Report of the commissioners on the Sutro tunnel. (See Ex. Docs. No. 15, 42d Congress, 2d session.)

14th. Evidence taken by the Committee on Mines and Mining, 42d Congress, 2d session.

15th. Reports of the United States Commissioners on Mines and Mining for the years 1866, 1867, 1868, 1869, 1870, and 1871.

HENRY WALDRON.

NATH. P. BANKS.

WORTHINGTON C. SMITH.

JAMES S. NEGLEY.

WALTER L. SESSIONS.

FRANCIS E. SHOBER.

PIERCE M. YOUNG.

CHAS. W. KENDALL.

WASHINGTON, *May 14*, 1872.

SUBSTITUTE FOR H. R. 1173.

As agreed on by the Committee on Mines and Mining.

A BILL

To aid in the construction of the Sutro tunnel from the proceeds of the sale of mineral lands.

Whereas our public lands contain mines of the precious metals which are unsurpassed in extent, and can, with proper development, be made speedily to enhance the value of all property, and thereby relieve the burdens of the people;

And whereas a wise policy indicates that the revenue derived from our mineral lands should, to some extent, be devoted again to the much-needed development of that important interest;

And whereas Congress, by an act approved July twenty-fifth, eighteen hundred and sixty-six, authorized the construction of a draining and exploring tunnel to the Comstock lode, in the State of Nevada, and granted to Adolph Sutro certain rights and privileges, which have been assigned, transferred, and set over to a corporation, duly organized under the laws of the State of California, and known as the "Sutro Tunnel Company;"

And whereas great benefits will accrue to the people of the United States from the construction of said tunnel, which, as a great geological survey, penetrating into an argenteriferous mountain to a greater depth than has yet been reached by any similar work in the world, will establish the value of our mineral domain;

And whereas the principal wealth of our mineral regions consists in low-grade ores, which can only be utilized by

means of improved reduction, concentration, and smelting works, for the erection of which extraordinary facilities exist at the mouth of said tunnel;

And whereas this work bears a national character, and its magnitude is beyond the capacity of private enterprise, and the security offered to the Government is ample for the repayment of any sums to be advanced under this act: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury is hereby authorized and directed to keep a separate account of all moneys received by the United States from the sale of mineral lands, and the same shall be used in fostering the mining interest, as Congress may hereafter direct.

SEC. 2. That whenever the Sutro Tunnel Company, a corporation duly organized under the laws of the State of California, shall have hereafter completed five hundred lineal feet, in the aggregate, of its tunnel and shafts, the Secretary of the Treasury, upon application to him by said company, shall from the aforesaid moneys, or from any other moneys in the Treasury not otherwise appropriated, pay as a loan to said company fifty thousand dollars; and in like manner shall pay as a loan to said company a like sum upon the completion by said company of each and every additional five hundred feet of said tunnel and shafts, as hereinafter specified: *Provided*, That each installment of said loan shall be paid by the Secretary of the Treasury to said company only after the said company shall have expended, according to the report of the commissioners hereinafter provided for, an additional equal amount of its own funds in the construction of said tunnel and shafts: *And provided further*, That all payments under this act shall be made out of appropriations hereafter to be made.

SEC. 3. That the President of the United States is hereby authorized to appoint a board of three commissioners and fix their compensation, and to fill vacancies in said

board whenever they occur; and whenever the superintendent of said company shall file in the Interior Department his sworn affidavit, setting forth that five hundred lineal feet in the aggregate of said tunnel and shafts have been completed in accordance with the provisions of this act, the Secretary of the Interior shall thereupon notify the said board of commissioners to examine the same, and it shall be the duty of said commissioners forthwith to make such examination; and if they find the same completed in conformity with this act, and in accordance with plans and specifications of said tunnel and shafts, to be approved by them, and filed in the office of the Secretary of the Interior, they shall file their report thereof with the Secretary of the Interior, who shall thereupon notify the Secretary of the Treasury that said company has become entitled to the payment of fifty thousand dollars under section two of this act, and the Secretary of the Treasury shall thereupon pay to said company the sum of money to which it is entitled; and from time to time, as other five hundred feet of said tunnel and shafts are completed, they shall be examined, reported upon, and like sums of money paid, as hereinbefore provided.

SEC. 4. That, in order to secure to the United States the repayment by said company of the sums so loaned, with interest thereon, and of the compensation of the commissioners, the payment of said sums shall, *ipso facto*, constitute a first mortgage and lien on the whole of said tunnel, together with all the lands, franchises, easements, privileges, engines, buildings, and appurtenances thereunto belonging. And, after the completion of said main tunnel to its intersection with the said Comstock lode, fifty per centum of the net amount collected for royalty, tolls, drainage, transportation of ore, rock, and material, or in any other manner, after deducting the necessary expenses, shall, on the first day of January and on the first day of July in each year, be paid by the said company into the Treasury of the United States, which moneys shall be applied to and be used for the repayment of the sums so loaned and paid,

together with interest thereon at the rate of five per centum per annum until the whole amount shall be repaid to the United States, and such net amount shall be ascertained and reported by the commissioners upon inspection of the books and accounts of said company, or otherwise, as they may deem proper; and on failure or refusal of said company to pay the said sums of money, or any part of them, when required so to do by the Secretary of the Treasury, in accordance with the provisions of this act, the said tunnel, with all the lands, franchises, easements, privileges, engines, buildings, and appurtenances thereunto belonging, may be taken possession of by the President of the United States for the use and benefit of the United States, as hereinafter provided.

SEC. 5. That the conditions upon which aid shall be extended to said work are as follows:

First. That the aggregate amount to be loaned under this act shall not exceed the sum of two millions of dollars; and said company shall prosecute the construction of said tunnel with all reasonable diligence, and shall complete the same to the Comstock lode within five years from the date of this act.

Second. That the said tunnel shall, from its initial point in the foot-hills near Carson river, extend in a westerly direction four miles, more or less, to and beyond the easterly limit of the Comstock lode, and branches shall be constructed from said tunnel northerly and southerly to such extent as may by said company be deemed profitable and expedient.

Third. That said main tunnel shall, throughout its entire length, have a cross sectional area of at least one hundred and forty square feet, including timbers and space for drainage, and shall, on or before its completion, be provided with all necessary timber supports, double railroad tracks, and working shafts, the whole work to be substantial, permanent, and workmanlike, and to be subject during its progress to the examination and approval of the board of commissioners herein provided for.

Fourth. That the last five hundred thousand dollars to be loaned under this act shall be retained by the United States until after the said company shall have erected reduction, concentration, and smelting works, of the most approved kind, at or near the mouth of said tunnel, at a cost of at least five hundred thousand dollars; and the said sum retained shall be paid to said company by the Secretary of the Treasury, whenever the said commissioners shall report, in the manner hereinbefore provided for, that the said company has complied with all the provisions of this act.

Fifth. That before any moneys shall be loaned by the United States, the said company shall file with the Secretary of the Interior an acceptance of this act, and a declaration that said company consents to be bound by the conditions herein imposed.

SEC. 6. That in case of failure on the part of said company to prosecute said work, or to complete said main tunnel within the period herein specified, or to keep the same in good repair and condition, or to repay the full amount of said loan and interest thereon within twenty years from the date of the passage of this act, or of neglect to perform any and all the conditions hereinbefore stated, at any time prior to the repayment to the Government of the said sums so loaned and paid, the President of the United States may declare all rights of said company under this act forfeited, and may take such proceedings as he may deem advisable to terminate the possession of said company.

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